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Westinghouse Hanford Company Environmental Surveillance Annual Report--200/600 Areas

Calendar Year 1989

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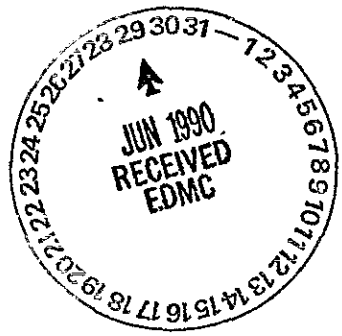

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WESTINGHOUSE HANFORD COMPANY ENVIRONMENTAL SURVEILLANCE ANNUAL REPORT--200/600 AREAS

Calendar Year 1989

J. W. Schmidt
C. R. Huckfeldt
A. R. Johnson
S. M. McKinney

ABSTRACT

This document presents the results of near-field environmental surveillance as performed by Westinghouse Hanford Company in 1989 for the Operations Area of the Hanford Site, Richland, Washington. These activities were conducted in the 200 and 600 Areas to assess operational control on the work environment. Surveillance activities included external radiation measurements and radiological surveys of waste disposal sites, radiological control areas, and roads, as well as sampling and analysis of ambient air, surface water, groundwater, sediments, soil, and biota.

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Calendar Year 1989

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EXECUTIVE SUMMARY

Near-field environmental surveillance for the Operations Area of the Hanford Site is performed by Westinghouse Hanford Company (Westinghouse Hanford) to assess and control the impacts of operations on the work environment. The results and conclusions of this program are presented in two annual reports: one for the 100 Areas and one for the 200 and 600 Areas. This report addresses the 1989 environmental surveillance results for the 200 and 600 areas.

Surveillance activities in the 200 and 600 Areas included sampling and analysis of ambient air, surface water, groundwater, sediments, soil, and biota, external radiation measurements and radiological surveys of waste disposal sites, radiological control areas, and roads. The 1989 data are summarized below.

REGULATORY CONTROLS

Radiation exposure to workers and the offsite population are regulated by a tiered system of controls. The U.S. Department of Energy (DOE) has established the occupational exposure limit at 5,000 mrem/yr. The exposure limits for any member of the public are set by the DOE at 500 mrem/yr for occasional annual exposures and at 100 mrem/yr for annual exposures expected to last longer than 5 yr. An administrative action level of 25 mrem/yr (to the maximum individual member of the public) has been identified by the DOE to ensure that these exposure limits are not exceeded.

Derived concentration guidelines (DCG) corresponding to the 100 mrem/yr effective dose equivalent standard are used for comparison purposes in this report. It should be noted that the DCG are applicable at the point of actual exposure to members of the public only (off the Hanford Site) and are, therefore, not applicable onsite. Westinghouse Hanford's philosophy is to keep exposures as low as reasonably achievable (ALARA). Westinghouse Hanford establishes ALARA requirements called administrative control values (ACV), which are used as guidance in maintaining releases below applicable regulatory standards.

AMBIENT AIR MONITORING

The concentrations of airborne radionuclides measured in the 200 Areas were many times less than the DCG. Results of a trend analysis using data collected since 1979 demonstrated a continued overall decline in airborne ^{137}Cs, ^{90}Sr, and ^{239}Pu in the 200 Areas because of continuing improvement in operational environmental control, as well as curtailed operations. All individual stations for measured radionuclides have been showing a general downward trend.

GROUNDWATER MONITORING

The groundwater beneath ten waste sites exceeded the DCGs on an annual average for 1989. Two sites were in use, and eight were inactive. None of the sites have projected offsite doses that exceed the DOE limits.

- The 1989 annual average for tritium in the groundwater beneath the active 216-A-45 Crib was 1.8 times the DCG. This was down from an annual average of three times the DCG in 1988. The groundwater beneath the inactive 216-A-5, 216-A-10, 216-A-36A, 216-A-36B, and 216-A-38 Cribs had an annual average of two times the DCG. Nearby wells in the area of the 216-A-38 Crib have also shown decreases, indicating plume movement.

- The annual average for the concentration of ^{90}Sr beneath the inactive 216-B-5 Reverse Well was six times the DCG in 1989; this is virtually unchanged from 1987 and 1988 levels.

- The ^{234}U and ^{238}U in the groundwater at the inactive 216-U-1/-2 Cribs marginally exceeded the DCGs. Concentration changes in the surrounding wells indicate plume movement towards the east.

The groundwater beneath six sites exceeded the ACVs on an annual average.

- The concentration of uranium isotopes exceeded the ACV at the active 216-U-17 and 216-S-25 Cribs, and at the inactive 216-S-21 and 216-U-1/-2 Cribs.

- The concentration of ^{137}Cs exceeded the ACV at the inactive 216-B-5 Reverse Well.

- The concentration of ^{99}Tc exceeded the ACV at the active 216-U-17 Crib and the inactive 241-SX Area.

SOIL AND BIOTA MONITORING

In 1989, the concentrations of radionuclides in surface soil at the grid sites throughout the 200 and 600 Areas were well below all Westinghouse Hanford soil standards (established to ensure compliance with DOE standards). The 200 East Area average soil concentration of ^{90}Sr, ^{137}Cs, and ^{239}Pu was only 0.14, 0.03, and 0.04 percent of the soil standards, respectively. The 200 West Area average soil concentration of ^{90}Sr, ^{137}Cs, and ^{239}Pu was only 0.11, 0.01, and 0.04 percent of the soil standards, respectively. Trend analysis revealed that the radionuclide concentrations in soil at the grid sites are consistent (i.e., no overall increase) with those identified over the past 11 years.

The only gamma-emitting radionuclide in vegetation samples collected from the grid sites that exceeded background levels (as established by Pacific Northwest Laboratory at the Hanford Site perimeter) was ^{137}Cs. The

^{137}Cs levels were slightly elevated above background at each of the 84 sites sampled. The average ^{137}Cs concentration in vegetation samples collected in the 200 East and 200 West Areas was 0.60 pCi/g and 0.64 pCi/g, respectively. The concentration of ^{137}Cs in vegetation has remained consistent with historical data.

EXTERNAL RADIATION MONITORING

Exposure rates from penetrating radiations, primarily gamma rays, were measured in the general 200 Areas environment with thermoluminescent dosimeters (TLD) and were found to be consistent with background levels. The environmental TLDs measured exposure rates from all types of external radiation sources, including cosmic radiation, naturally occurring radioactivity in air and soil, fallout from nuclear weapons testing, and contributions from 200 Areas activities. In 1989, operations in the 200 Areas did not contribute significantly to the external exposure rate (as measured by Pacific Northwest Laboratory) in the general environment. Consequently, the exposure rate in the 200 Areas was not significantly different from the exposure rate received offsite from natural sources of radiation. As expected, external radiation levels were elevated at certain sites, radiological control areas, and facilities, reflecting the proximity of these regions to radioactive waste management activities.

POND AND DITCH MONITORING

While there were some increases in radioactivity observed in the ponds and ditches in 1989, none of these levels exceeded the applicable standards. All surface waters associated with 200 Areas operations were below the respective DCG for each measured radionuclide. In addition, the analytical results of vegetation samples taken at the ponds and ditches revealed that physiological uptake of radionuclides was relatively insignificant. Analyzed sediment samples demonstrated elevated levels of radionuclide (mainly ^{137}Cs). All ponds and ditches that receive potentially contaminated water are within posted radiological control areas.

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1.0 INTRODUCTION

1.1 SITE HISTORY

Westinghouse Hanford Company (Westinghouse Hanford), as the Operations and Engineering Contractor for the U.S. Department of Energy (DOE) at the Hanford Site, has, as a part of its mission, the responsibility of managing the fuel reprocessing and radioactive waste management facilities in the 200 East and West Areas. Westinghouse Hanford also maintains the retired radioactive dry-waste disposal sites in the 600 Area.

The Hanford Site is located within the Pasco Basin in southcentral Washington State, approximately 170 mi southeast of Seattle and 125 mi southwest of Spokane. As shown in Figure 1-1, the 200 Areas are centrally located on the Hanford Site, 7 mi south of the Columbia River. The locations of operating facilities, tank farms, solid waste burial grounds, and liquid disposal sites in the 200 Areas are shown in Figures 1-2 and 1-3.

Westinghouse Hanford conducts the Operational Environmental Surveillance Program in the 200 and 600 Areas to assess and control the impact of past and present operations on the work environment.

1.2 OBJECTIVES OF THE OPERATIONAL ENVIRONMENTAL SURVEILLANCE PROGRAM

The objectives of the 200 and 600 Areas Operational Environmental Surveillance Program are three fold.

- Ensure compliance with DOE and internal Westinghouse Hanford radiation protection guides.
- Evaluate the performance of radioactive waste confinement systems.
- Assess the long-term trends of radioactive materials in the work environment.

Environmental protection requirements for use in the 200 and 600 Areas have been developed using administrative control values (ACV) (see Appendix I) to limit radionuclide concentrations. These ACVs were established to (1) maintain occupational radiation exposure at levels that are as low as reasonably achievable (ALARA) (DOE 1986) and (2) to ensure that offsite limits are not exceeded. Operational Environmental Monitoring evaluates compliance with established requirements and policies, and the Operational Environmental Monitoring Program for the 200 and 600 areas has been designed to meet the site-specific needs of these Areas.

This report presents and interprets the results of the operational environmental surveillance activities performed in the 200 and 600 Areas during 1989.

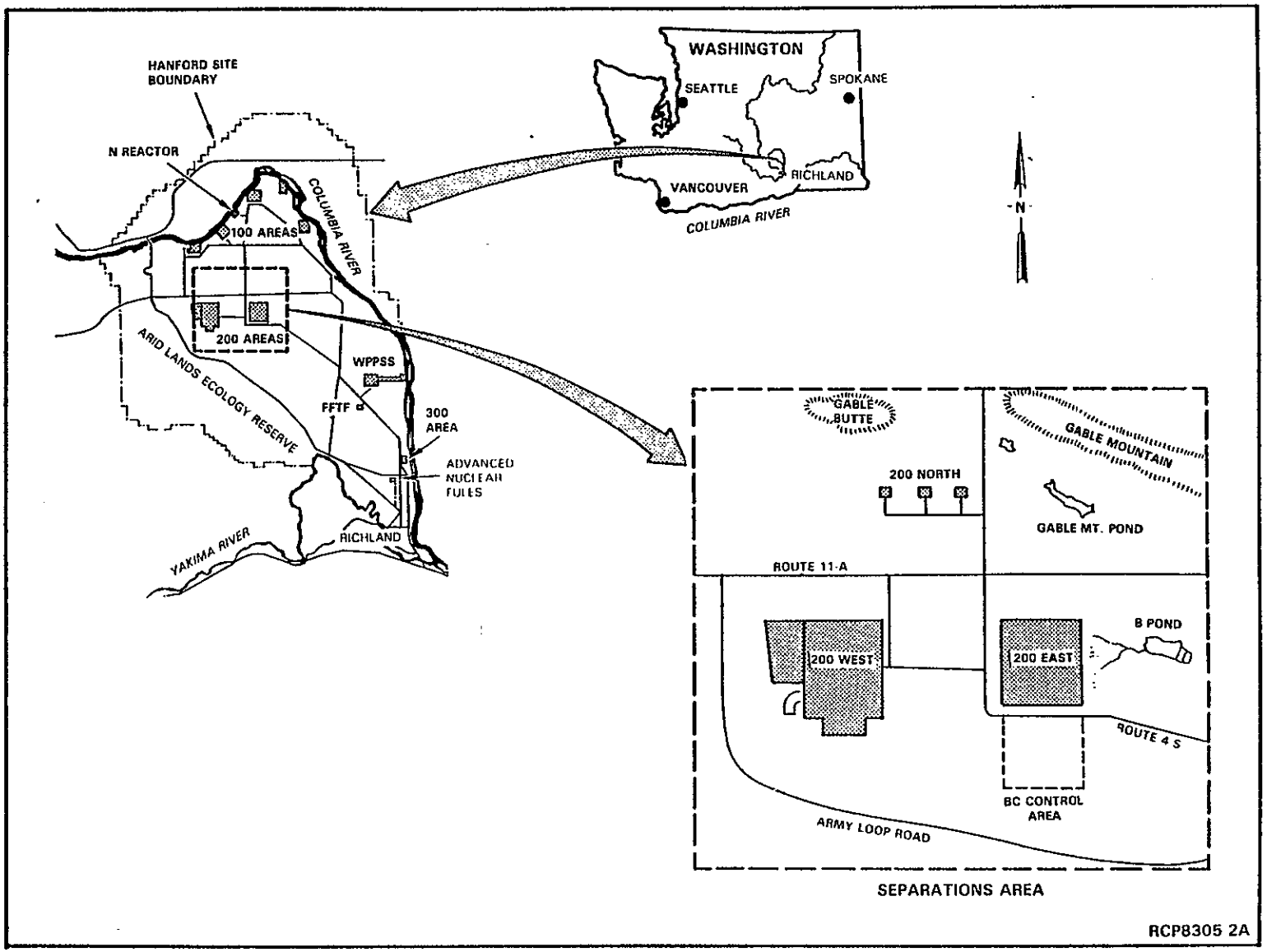
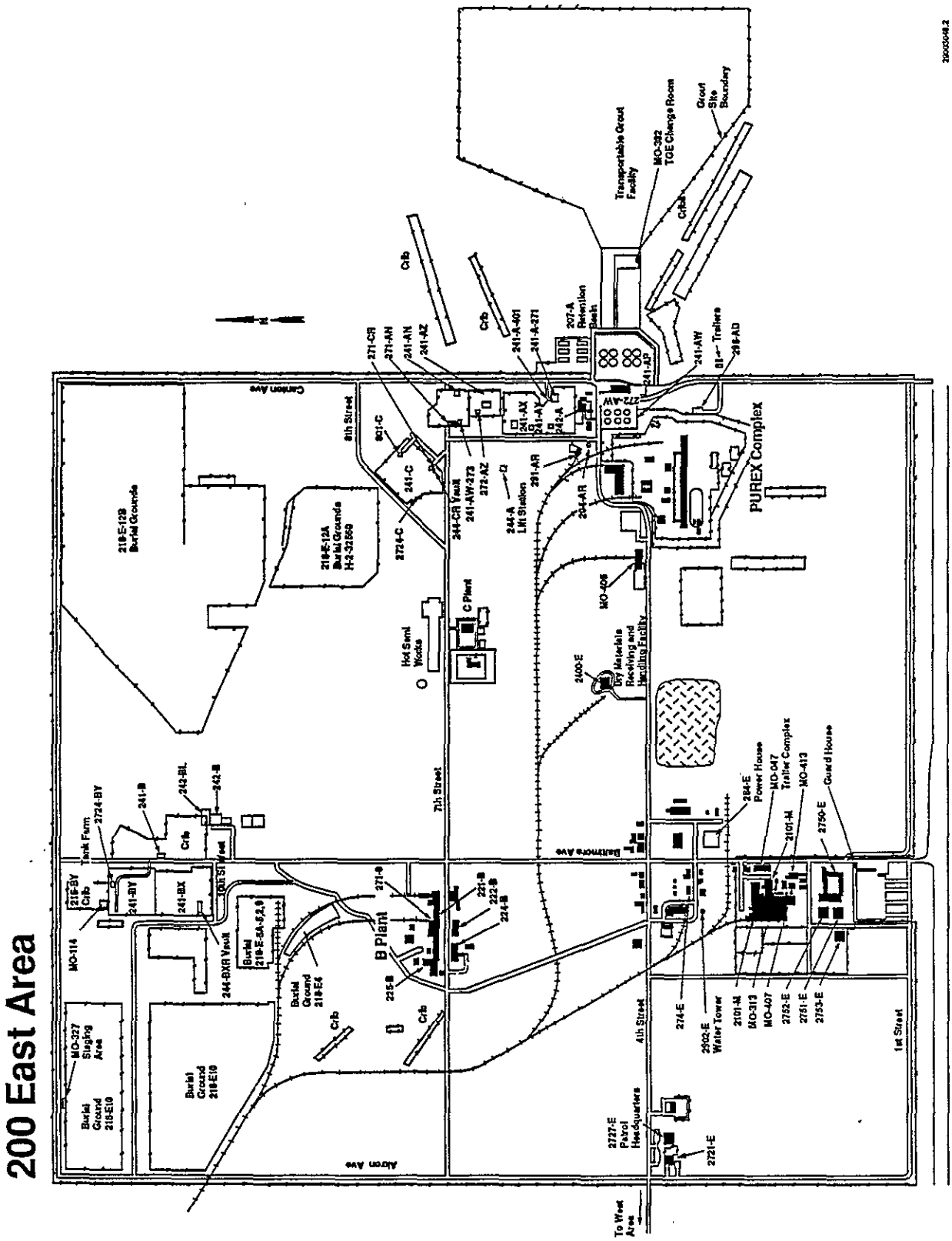


Figure 1-1. The Separations Area of the Hanford Site.

Figure 1-2. The 200 East Area.



1.3 SITE CHARACTERISTICS

1.3.1 Chemical Processing Facilities

1. Plutonium-Uranium Extraction Plant--The Plutonium-Uranium Extraction (PUREX) Plant processes irradiated fuels from N Reactor to recover special materials (e.g., plutonium, neptunium, and uranium) and produces plutonium nitrate or plutonium oxide and uranyl nitrate. This process includes metal dissolution and solvent extraction. Supporting systems provide for the removal of nitric acid and organic compounds and the concentration and treatment of waste.

2. Uranium Oxide Plant--The Uranium Oxide (UO_3) Plant produces UO_3 powder by calcining uranyl nitrate solutions from the PUREX Plant. The UO_3 powder is sealed in steel drums for shipment offsite.

3. Plutonium Finishing Plant--The Plutonium Finishing Plant (PFP) processes and prepares plutonium products. At the PFP, the Plutonium Reclamation Facility produces plutonium nitrate, and the Plutonium Processing Facility converts plutonium nitrate to either plutonium oxide or metal.

4. T Plant--The T Plant was originally a fuels separation facility. The facility is now used for decontamination and repair of equipment.

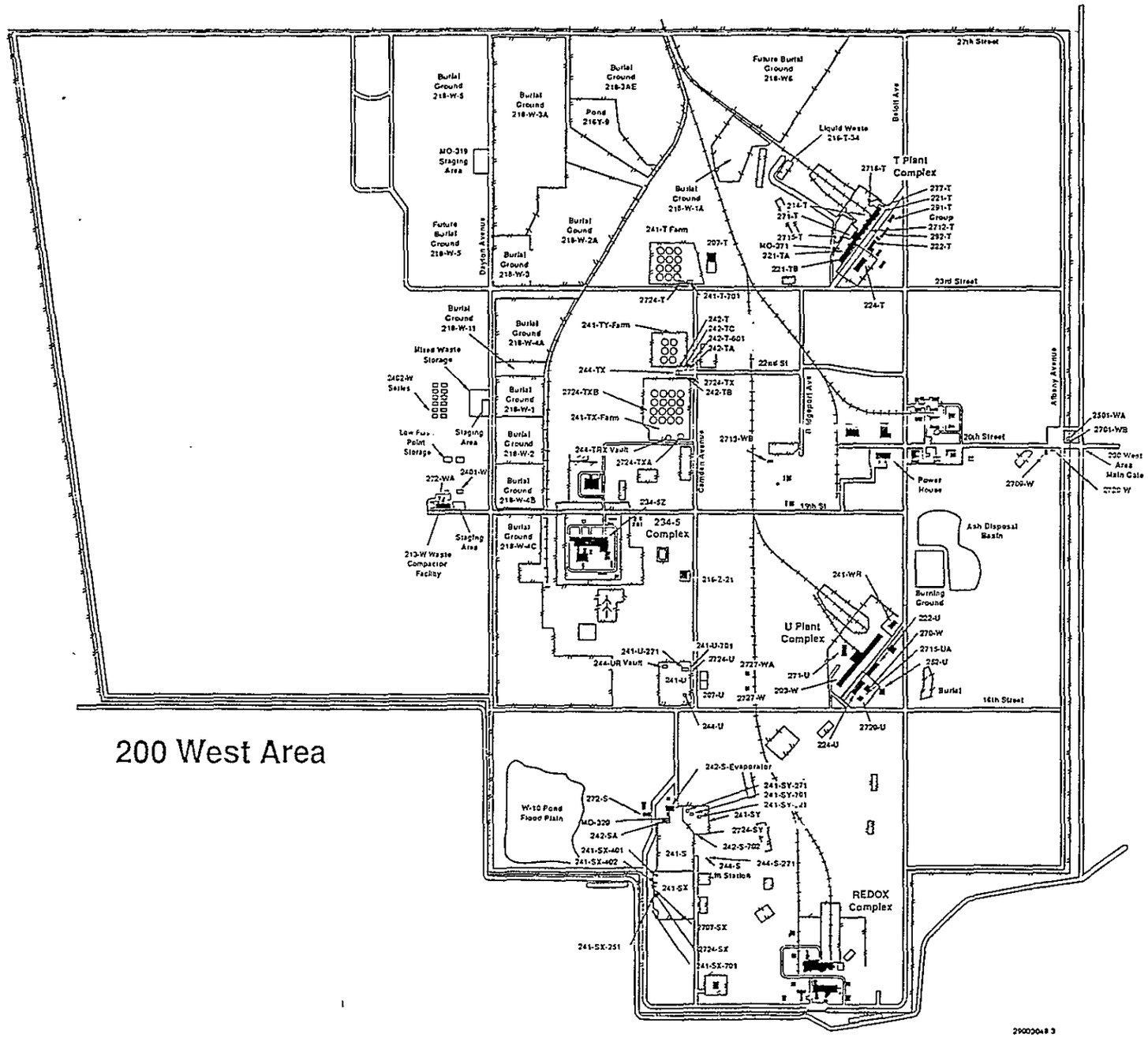
1.3.2 Waste Management Facilities

1. Tank Farms--Liquid waste from chemical processing operations, which contain high concentrations of radionuclides, is stored on an interim basis in underground tanks. The Hanford Site tank farms contain 177 tanks (149 single-shell tanks and 28 double-shell tanks) with capacities ranging from 50,000 to 1,000,000 gal. Since 1967, new liquid waste has been stored only in double-shell tanks. The single-shell tanks no longer receive waste and are planned for disposal.

Associated with the tank farms are the evaporators. These facilities are used to remove water from the liquid waste, thereby reducing the total volume of waste stored by the tank farms. During 1989, the 242-A Evaporator was operational, and the 242-S Evaporator was on standby.

2. B Plant/Waste Encapsulation and Storage Facility--The scope of work for B Plant and the Waste Encapsulation and Storage Facility is in a state of change. Limited amounts of ^{137}Cs were shipped to customers in 1989; however, current encapsulation processes for ^{90}Sr and ^{137}Cs are on standby. Upgrades are also under way at B Plant to prepare for support of the vitrification and grout projects.

Figure 1-3. The 200 West Area.



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3. Cribs--Low-level liquid waste is discharged to the ground via structures called cribs. These subsurface systems allow the liquid component of the waste to percolate into the soil. Of the 98 cribs in the 200 and 600 Areas, 13 were active in 1989.

4. Ponds--Ponds are used to manage the large quantities of water (i.e., cooling water and steam condensate) associated with chemical processing operations. These liquid effluents are normally uncontaminated. The ponds function to promote percolation of the liquid effluent into the soil column. Of the nine ponds in the 200 and 600 Areas, only one remained active at the end of 1989.

5. Ditches--A ditch is an open, unlined excavation used for disposing of liquid effluents or for transporting liquid effluents to ponds. Of the 16 ditches in the 200 and 600 Areas, seven were active in 1989.

6. French Drains and Reverse Wells--French drains and reverse wells are pipes or rock-filled encasements inserted into the ground. These subsurface systems are used for percolating potentially contaminated liquid waste into the soil column. Of the 37 process facilities in the 200 Areas, none were active in 1989. These facilities terminate 200 or more feet above groundwater.

7. Solid Waste Disposal Sites--Contaminated solid waste is generated by various activities on the Hanford Site. This waste is buried in shallow trenches in the 200 Areas. The particular waste packaging procedure and burial practice employed depends on the type of waste. Of the 33 solid waste disposal sites in the 200 Areas, seven remained active in 1989.

1.3.3 Waste Site Identification and Cleanup

An ongoing process exists to investigate and identify suspect waste sites at the Hanford Site. As a result, three sites were added to the Waste Site Information Data System in 1989 with 54 sites undergoing investigation.

Westinghouse Hanford activities in the 200 Areas also involve decontamination and decommissioning (D&D) of retired facilities, equipment, and waste disposal sites. These activities prevent the release or spread of contamination and/or reduce the number of radiological control areas.

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2.0 AMBIENT AIR MONITORING

2.1 INTRODUCTION

Ambient air sampling is conducted (1) to determine baseline concentrations of radionuclides in the 200 Areas and (2) to assess the impact of operations on the local environment. These measurements also provide an indication of the 200 Areas facility performance and are used to demonstrate compliance with environmental protection criteria. The Westinghouse Hanford air sampling program in the 200 and 600 Areas, as illustrated in Figures C-1, C-2, and C-3 of Appendix C, takes into consideration prevailing and high wind directions, as well as potential source terms. Meteorological conditions are continuously monitored by Pacific Northwest Laboratory (PNL) meteorology stations, which are strategically positioned around the Hanford Site.

All Hanford Site air samplers in the 200 and 600 Areas are operated at a flow rate of 2 ft^3/min, drawing the sample through a 47-mm, open-face filter at about 3 ft above the ground. New DOE Orders may require increasing sampler height.

In 1989, four air sampling stations were removed from service, bringing the total number of permanent stations to 52. The stations removed from service were N006, N007, N008, and N012, located, respectively, north, south, and east of the 241-AP Tank Farm and northeast of the 207-A Retention Basin. In conjunction with routine particulate filters, silver zeolite (AgX) cartridges were used at these four stations to monitor gaseous radioisotopes. A combination particulate filter and AgX cartridge was also removed from service at the east air intake of 272-AW (N996). One of four temporary stations, set up to monitor the D&D efforts at the Strontium Semi-Works in the 200 East Area, was made into a permanent station. Three temporary stations (N001, N002, and N004) were removed from service, while N003 was left in service.

The network of 52 air samplers operates on a continuous basis in and around the 200 Areas. Three of the 52 samplers are distant from the 200 Areas and are used to provide background data: one each at the Yakima and Wye Barricades and one at the Hanford Townsite. All sample filters are exchanged weekly, held one week (to allow for decay of the short-lived natural radioactivity), and then sent to the 222-S Laboratory for initial analysis of gross alpha and gross beta activity. These initial analyses serve as an indicator of potential environmental problems. After the initial analysis, the filters are stored until the end of the calendar quarter, at which time they are composited by sample location (or as deemed appropriate) and sent to the U.S. Testing Company, Inc., Richland, Washington, for specific radionuclide analysis. Of the analyses performed, four are routinely reported: ^{137}Cs, ^{90}Sr, ^{239}Pu, and total uranium. The compositing of the air filters by sample location provides a larger sample size and, thus, a more accurate measurement of the concentration of airborne radionuclides resulting from operations in the 200 Areas. To help access the impact of operations, the results obtained must be compared to background data. Because of the sensitivity of air monitoring to the sampling techniques, direct

comparisons to background data by PNL cannot be made (e.g., PNL collects a larger sample per filter and composites multiple sites). Therefore, Westinghouse Hanford set up the three distant stations to obtain background data using sampling techniques identical to the rest of the program.

2.2 AIR SAMPLING RESULTS, 1989

2.2.1 Summary

The concentrations of airborne radionuclides measured in 1989 in the 200 Areas were many times less than the derived concentration guidelines (DCG). The 1989 air sampling results are summarized in Tables C-1, C-2, and C-3 of Appendix C. The annual average radionuclide concentrations since 1979 are illustrated in Figures C-4 through C-9. All sites were well below the applicable DOE guidelines (See Appendix I) in 1989. The results of the isotopic analysis are as follows.

2.2.1.1 Strontium-90 Results. The highest annual average result for ^{90}Sr was at N962, located southeast of the 218-W-4B Burial Ground in the 200 West Area. The result was 6.1×10^{-4} pCi/m^3, or 0.01% of the DCG. For comparison purposes, this was 20 times greater than background.

2.2.1.2 Cesium-137 Results. The highest annual average result for ^{137}Cs was at N155, located near the U-Tank Farm in the 200 West Area. The result was 3.9×10^{-3} pCi/m^3, or about 0.0009% of the DCG. For comparison purposes, this was 71 times greater than background.

2.2.1.3 Plutonium-239 Results. The highest annual average for ^{239}Pu was at site N158, located near the AX Tank Farm in the 200 East Area. The result was 8.9×10^{-4} pCi/m^3, or 2% of the DCG. The average was 95 times greater than background. The trend for ^{239}Pu continues downward in both the 200 East and 200 West Areas.

2.2.1.4 Total Uranium Results. The highest annual average for total uranium was at site N976, located at grid site 2E17 in the 200 East Area. The result of 8.6×10^{-5} pCi/m^3 was 20 times greater than the overall average for total uranium. No total uranium was detected at any of the other Hanford Site background locations. These slightly elevated concentrations are attributed to UO_3 Plant operations.

2.3 CONCLUSIONS

Activities in the 200 Areas contributed to average air radionuclide concentrations that were only slightly above background. Trends over the past 10 years have generally been downward for both 200 East and 200 West Area averages because of an overall improvement in operational environmental

controls and curtailed operations. All radionuclide concentrations were below the DCG in 1989. With the exception of the very slight upward trend of ^{239}Pu at N165 southeast of PFP, all individual stations continue to show a general downward trend for all measured radionuclides.

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3.0 GROUNDWATER MONITORING

3.1 INTRODUCTION

This section compares the quality of groundwater beneath the 200 Areas and associated waste sites with Westinghouse Hanford ACVs and with DCGs. The ACVs for the Separations Area facilities and operations are contained in WHC-CM-7-5, *Environmental Compliance Manual* (WHC 1989) and are listed in Table 3-1. Included are a brief description of Westinghouse Hanford's groundwater monitoring program, concentration summaries for active and inactive waste sites, and a summary of significant concentration trends that began in, or continued into, 1989. Comprehensive data from all monitored wells in the Separations Area will appear in a separate groundwater monitoring annual report to be issued by the Geosciences Group, Environmental Engineering Technology, and Permitting.

Westinghouse Hanford conducts the 200 Areas groundwater monitoring program to determine the compliance status of 200 Areas facilities and operations. The objectives of the program are as follows.

- Evaluate the quality of groundwater beneath the 200 Areas.
- Determine the impact of waste disposal operations on the groundwater.
- Assess the performance of disposal and storage sites in the 200 Areas.
- Provide data for hydrologic analysis and model application.

3.2 MONITORING PROGRAM DESCRIPTION

The groundwater monitoring network for the 200 Areas consists of 166 wells. Of these 166, 133 wells in the unconfined aquifer and 13 wells in the confined aquifer were monitored during 1989. The groundwater monitoring well locations are shown in Figures D-1 through D-3 of Appendix D.

The sampling of all groundwater monitoring wells was halted in April 1989, to await a decision from the Washington State Department of Ecology (Ecology) concerning the disposition of the purgewater generated by the sampling activity. As a result, groundwater samples were not taken during the months of April, May, June, July, and most of August.

Samples were collected for Westinghouse Hanford by PNL and transported to the U.S. Testing Company, Inc., in Richland, Washington, for analysis. Wells for the operational groundwater monitoring are sampled monthly, quarterly, or semiannually, depending on the operating history or the level and rate of change of contamination. Most wells are equipped with dedicated submersible pumps; the remainder are sampled by bailing.

Table 3-1. Administrative Control Standards for Radioactive Groundwater.

Radionuclide	200 East Area	200 West Area	600 Area	DCG	Units
^{3}H	None	None	None	2,000,000	pCi/L
^{60}Co	5,000	5,000	5,000	5,000	pCi/L
^{90}Sr	74	480	40	1,000	pCi/L
^{99}Tc	4,000	4,000	4,000	100,000	pCi/L
^{106}Ru	6,000	6,000	240	6,000	pCi/L
^{129}I	20	20	20	500	pCi/L
^{137}Cs	210	1,200	120	3,000	pCi/L
^{234}U	20	20	20	500	pCi/L
$^{235}U, ^{238}U$	24	24	24	600	pCi/L
^{238}Pu	2.0	3.6	1.6	40	pCi/L
$^{239}Pu, ^{240}Pu$	1.2	1.2	1.2	30	pCi/L

Legend:
DCG = Derived concentration guideline.
pCi/L = picocuries per liter.

The analytical parameters in 1989 included total alpha, total beta, ^{60}Co, ^{90}Sr, ^{99}Tc, ^{129}I, ^{137}Cs, ^{106}Ru, ^{3}H, $^{234,235,238}U$, total uranium, and $^{238,239,240}Pu$. Water samples from wells were selectively analyzed for these parameters based on effluent inventories and historical groundwater monitoring results. Sampling quality control is discussed in *Hanford Site Environmmental Report for Calendar Year 1988* (PNL 1989).

Analytical results were reported by U.S. Testing Company to both the 200/600 Areas Environmental Protection Section and the Geosciences Group. The data were analyzed and reported quarterly; however, quarterly reports are only available for the months sampled.

Westinghouse Hanford has established ACVs pertaining to radionuclide concentrations in groundwater, which are specified in Part N of WHC-CM-7-5, (WHC 1989). The intent of these ACVs is to ensure that, at the end of institutional control and prior to offsite migration, the groundwater beneath the site will be at or below the 0.04 DCG, which corresponds to 4 mrem/yr effective dose equivalent for radioactivity from current or future operations. It should be recognized that past accidents and practices may preclude meeting this standard with regard to some isotopes. The ACVs serve as operating limits regulating discharges to liquid disposal sites and, as such, are more restrictive than the DCGs. Inactive liquid-waste disposal sites (i.e., those no longer receiving wastewater) continue to be monitored to detect changes that could indicate a potential problem.

3.3 CONCENTRATION SUMMARY

The annual average concentration of radionuclides in groundwater beneath 200 Areas waste sites was compared to the ACVs as well as the DCGs. It should be noted that the DCGs are applicable only at the point of actual exposure to members of the public (off the Hanford Site) and are, therefore, not applicable onsite. Table 3-1 presents a comparison of the current ACVs and DCGs. Liquid-waste disposal sites that exceeded the ACVs or the DCGs are summarized as follows according to the contaminant involved.

3.3.1 Tritium

The groundwater beneath one active waste site and four inactive waste sites exceeded the DCG for ^{3}H in 1989. The active 216-A-45 Crib, which receives PUREX Plant effluents, was approximately 1.5 times the DCG. This elevated concentration of ^{3}H in the crib is attributed to past practices in the area. Wells at inactive sites in the vicinity of this crib also showed ^{3}H concentrations in excess of the DCG. The inactive 216-A-05, 216-A-10, 216-A-36A, 216-A-36B, and 216-A-38 Cribs remained above the DCG in 1989. The ^{3}H concentrations in the 216-A-38 Crib dropped from 2.5 times the DCG in 1988 to 1.8 times the DCG in 1989, indicating plume movement. The concentrations are expected to be below the DCG by the time the groundwater reaches the Columbia River. An ^{3}H plume map for the Separations Area can be found in a separate groundwater monitoring annual report to be issued by the Geosciences Group of Environmental Engineering, Technology, and Permitting.

3.3.2 Strontium-90

No active waste sites exceeded the ACV or DCG for ^{90}Sr.

One inactive waste site had elevated concentrations of ^{90}Sr in the groundwater. The groundwater beneath the inactive 216-B-5 Reverse Well had an annual average ^{90}Sr concentration of approximately six times the DCG and 83 times the ACV. The concentration has remained unchanged since 1985. The elevated ^{90}Sr concentration at this site is due to the direct discharge of contaminants to the water table. Except for the 216-B-5 Reverse Well, all other reverse wells previously discharged into the vadose zone. This site, however, discharged directly into the water table from 1945 through 1947 (Law and Allen 1984). The high ^{90}Sr concentration is due to residual contamination from that period of operation. Characterization has demonstrated that the radionuclides are sorbed on the sediments and that the contamination is localized (Smith 1980).

3.3.3 Technetium-99

One active waste site, the 216-U-17 Crib, exceeded the ACV for ^{99}Tc. The groundwater beneath one inactive waste site, the 241-S Area, was found to have ^{99}Tc in excess of the DCG. The ^{99}Tc is from past disposal practices. The concentration of ^{99}Tc at the 216-U-1 and 216-U-2 Cribs was below the ACV in 1989. The concentration of ^{99}Tc beneath the 216-U-17 Crib was four times the ACV. The elevated ^{99}Tc concentration in the 200 West Area coincides with the elevated concentration of uranium. The ^{99}Tc concentration at the 216-B-48, 216-B-49, and 216-B-50 Cribs remained below the ACV in 1989.

3.3.4 Iodine-129

No waste sites exceeded the DCG or ACV for ^{129}I during 1989. Seven wells were analyzed for ^{129}I in 1989. Wells at 216-A-10, 216-A-27, 216-A-36B, and 216-A-45 Cribs and a well (699-35-70) east of the Reduction-Oxidation (REDOX) Plant were sampled for ^{129}I. The 216-A-45 Crib, which receives the PUREX process condensate, was also routinely sampled for ^{129}I.

3.3.5 Cesium-137

The average annual concentration of ^{137}Cs at the inactive 216-B-5 Reverse Well was below the DCG but five times greater than the ACV. The concentration has been decreasing for the past five years.

3.3.6 Plutonium

Two inactive waste sites, the 216-B-5 Reverse Well and the 216-S-19 Pond, exceeded the DCG for ^{239}Pu in 1989. This was first noted in 1988 due to more restrictive control limits being implemented internally by Westinghouse

Hanford at the end of 1988. The ACV was reduced by two orders of magnitude from 120 pCi/L to 1.2 pCi/L.

3.3.7 Uranium

The DCGs for uranium isotopes were not exceeded in the groundwater beneath any active waste sites in 1989. However, the groundwater beneath two active sites exceeded the ACVs. The concentrations of ^{234}U and ^{238}U remained below the ACVs for the 216-B-62 Crib in 1989.

The groundwater beneath the 216-S-25 Crib was above the ACVs for ^{234}U and ^{238}U. The concentrations are marginally above the ACVs and are equivalent to the results in 1987 and 1988.

The concentrations of ^{234}U, ^{235}U, and ^{238}U beneath the 216-U-17 Crib, which will receive the UO_3 Plant process condensate during future operations, were above the ACVs. The contamination is from other waste sites within the 200 West Area. The characterization of the plume was restarted in 1989 with the drilling of three groundwater monitoring wells.

The groundwater beneath two inactive sites had concentrations of uranium isotopes that exceeded the ACVs. The 216-U-1/-2 Cribs exceeded the DCGs for ^{234}U and ^{238}U. Two wells, 222-W19-03 and 299-W19-09, exceeded the DCG for ^{234}U and ^{238}U. The concentrations were down from those reported in 1987, 1988, and 1989. The decline in concentrations of ^{234}U and ^{238}U indicates plume movement.

Another inactive site, the 216-U-10 Pond, had ^{234}U and ^{238}U concentrations slightly in excess of the ACVs in 1988, but remained below the concentration limits in 1989. The concentration remained unchanged in well 299-W18-15 during 1989, but increased in well 299-W23-04, which monitors the 216-S-21 Crib; thus indicating plume movement. The concentrations of ^{234}U and ^{238}U in well 299-W23-04 were 2.5 times the ACVs.

3.3.8 Other Radionuclides

No other radionuclides were detected in excess of the ACVs or DCGs in any groundwater wells monitoring the Separations Area waste sites.

3.4 TRENDS

All groundwater data are analyzed (1) to determine compliance with internal guidelines, (2) to detect trends and potential problems, and (3) to demonstrate the effectiveness of waste site decommissioning.

Concentration trends in groundwater were observed beneath two active and four inactive waste sites. The trends are summarized as follows and are shown graphically in Figures D-4 through D-9 of Appendix D.

- 216-B-62 Crib: In general, the concentration of uranium in the groundwater beneath this active crib continued to decrease during 1989 (Figure D-4).

- 216-S-25 Crib: A slight increase in uranium concentration is evident in well 299-W23-09 and a slight decrease in well 299-W23-10 during 1989 (Figure D-5). This event follows pumping of treated groundwater from the 216-U-1/-2 Cribs, which ended in November 1985.

- 216-U-1/-2 Cribs: Of the six wells surrounding this inactive crib area, three wells were sampled during 1989. The uranium concentration at these wells continued to decrease in 1989 (Figure D-6). This suggests movement of the plume and sorption on the soil sediments.

- 216-U-17 and 216-U-8 Cribs: Of the six wells adjacent to the new 216-U-17 Crib, three indicate a slight increase in uranium during 1989 (Figure D-8). The increase in uranium in the region of the 200 West Area coincides with a decrease in uranium beneath the inactive 216-U-8 Crib (Figure D-9). A characterization of the plume, to determine the source and extent of the contamination, began in 1989 with the drilling of new wells.

3.5 CONCLUSIONS

The groundwater beneath 10 waste sites exceeded the DCGs on an annual average for 1989. Two sites were active, and eight were inactive. None of the sites have projected offsite doses that exceed the DOE limits. The results are summarized as follows.

- The 1989 annual average for ^{3}H in the groundwater beneath the active 216-A-45 Crib was 1.8 times the DCG. This was down from an annual average of three times the DCG in 1988. The groundwater beneath the inactive 216-A-05, 216-A-10, 216-A-36A, 216-A-36B, and 216-A-38 Cribs had an annual average of two times the DCG. Nearby wells in the area of the 216-A-38 site have shown decreases, indicating plume movement.

- The annual average for the concentration of ^{90}Sr beneath the inactive 216-B-5 Reverse Well was six times the DCG in 1989; this is virtually unchanged from 1987 and 1988 levels.

- The concentration of ^{234}U and ^{238}U in the groundwater at the inactive 216-U-1/-2 Cribs exceeded the DCGs. Concentration changes in the surrounding wells indicate plume movement toward the east.

The groundwater beneath six sites exceeded the ACVs on an annual average. The results are summarized as follows.

- Uranium isotopes exceeded the ACV in the groundwater at the active 216-U-17 and 216-S-25 Cribs and at the inactive 216-S-21 and 216-U-1/-2 Cribs.
- The ^{137}Cs concentration exceeded the ACV in the groundwater beneath the inactive 216-B-5 Reverse Well.
- The ^{99}Tc concentration exceeded the ACV in the groundwater beneath the active 216-U-17 Crib and the inactive 241-SX Area.

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4.0 SOIL AND BIOTA MONITORING IN THE 200 AREAS

4.1 INTRODUCTION

The radionuclide content of soil and vegetation is measured to evaluate long-term trends in environmental accumulation of radioactivity in the 200 Areas. Soil samples are collected from a network of 30 fenceline sampling plots from various stabilized sites throughout the 200 and 600 Areas. The 30 fenceline plots are each 1 m by 1 m and were established in 1984 to monitor areas both upwind and downwind of potential sources where contamination, if present, might be expected to accumulate. Locations of the fenceline plots are illustrated in Figures E-5 and E-6 of Appendix E. Each soil sample represents a composite of five plugs of soil 2.5 cm in depth by 10 cm in diameter collected from within each sampling site.

Early in the summer of each year, soil samples are collected and submitted for radionuclide analyses. The analyses include those radionuclides expected in the Separations Area (i.e., gamma-emitting radionuclides, strontium isotopes, uranium, and plutonium isotopes). The results are compared to regional background levels, which are derived from PNL offsite monitoring data, to determine the difference between contributions from 200 Areas operations and contributions from natural causes and worldwide fallout. The results are also compared to the soil contamination standards (Appendix I) developed for use at the Hanford Site. For the purposes of soil disposal, two sets of standards are in use at the Hanford Site. The first is a threshold limit, below which the soil can be disposed of without the controls of the Low-Level Waste Burial Grounds. The intent of this threshold limit is to ensure that individual effective dose equivalents do not exceed 25 mrem/yr total under any reasonable scenario. The second limit defines when an area needs to be posted as a radiological control area. The range between the two limits does not need posting, but, when disposing of such contaminated soil, the soil needs to be treated as radioactive. The soil standards are intended for use only at the Hanford Site.

When soil samples are collected from the sites, terrestrial vegetation samples (e.g., cuttings from growing plants) are also collected to determine the accumulation of radioactivity in plants. Analyses are performed for gamma-emitting radionuclides and for ^{90}Sr and plutonium isotopes at selected sites.

Special soil and biota (plant and animal) samples are collected for site-specific monitoring or whenever radiological contamination is known or suspected to have occurred.

4.2 SOIL SAMPLING RESULTS, 1989

4.2.1 Grid Site Soil Sampling

All 33 grid sites, which included five from the Grout Site, were sampled in 1989. None of the sites approached Westinghouse Hanford's soil standards (Appendix I). The soil radionuclide concentrations are listed by area in Tables E-1 and E-2 (see Appendix E).

4.2.1.1 Cesium-137 Results. The highest ^{137}Cs concentration was, as in previous years, found at grid site 2W23, located east of the 241-U Tank Farm in the 200 West Area. This site, along with 2W8 (adjacent to the 241-T Tank Farm in the 200 West Area) has consistently shown the highest levels of ^{137}Cs since the grid sampling program was initiated in 1978. However, the trend at both sites has been generally downward since 1978, indicating that the elevated levels of ^{137}Cs in soil are due to past operations of the U and T Tank Farms. The 1989 result for 2W23 was 58 pCi/g, approximately 0.3 % of Hanford Site soil standard for ^{137}Cs.

The highest ^{137}Cs concentration in the 200 East Area was at grid site 2E12, located northeast of the 200 East Area. The 1989 result for 2E12 was 24 pCi/g, or 0.12 % of the Hanford Site soil standard.

4.2.1.2 Strontium-90 Results. The highest ^{90}Sr concentration was at grid site 2E17, located west of C Tank Farm in the 200 East Area. Samples from this site have historically been among the highest for concentrations of ^{90}Sr. Since 1984, an upward trend has become evident at this site. This is believed to be due to residual low-level contamination from the 1985 C-151 Tank Farm incident (Elder et al. 1986). The ^{90}Sr concentration at this site in 1989 was 3.1 pCi/g (down from 3.4 pCi/g in 1987), or approximately 1.0 % of the Hanford Site soil standard.

The highest ^{90}Sr concentration in the 200 West Area was at 2W23, located east of the 241-U Tank Farm. The ^{90}Sr result for 1989 for this site was 1.54 pCi/g, or 0.26 % of the Hanford Site soil standard.

4.2.1.3 Plutonium-239 Results. Soil samples with ^{239}Pu concentrations above background have been predominately found in the 200 West Area. The highest concentration found in 1989 was at 2W23, located east of the 241-U Tank Farm in the 200 West Area. The concentration at this site was 1.53 pCi/g, or 2.0 % of the Hanford Site soil standard.

Other radionuclides were found in the grid site soil samples but were determined to be insignificant when compared to the aforementioned radionuclides.

4.2.2 Fenceline Soil Sampling

Fenceline sampling sites have a different purpose than the grid sites in that they are designed to be site-specific to facilities where there is a greater potential for radionuclide buildup. Sample sites are located upwind and downwind with respect to the prevailing and high winds to detect any release of radioactive contamination from the facility. Of the 26 sites sampled in 1989, all demonstrated radionuclide concentrations for at least one radionuclide above regional background levels, and only one site approached Westinghouse Hanford's internal soil standard. Concentrations are listed in Table E-3.

4.2.2.1 Cesium-137 Results. The highest ^{137}Cs concentration was found at site B-TF-NE, located on the northeast corner of the 241-B Tank Farm in 200 East Area. Samples from this site have been among the highest measurements of ^{137}Cs. The concentration measured in 1989 was 200 pCi/g, about 1.0% of the soil standard. This site is part of a radiological control area.

The highest ^{137}Cs concentration in 200 West Area was found at site U-TF-NE, northeast of the 241-U Tank Farm. Samples from this site have exhibited elevated levels of ^{137}Cs since initiation of the fenceline sampling program in 1984 but no discernable trend has been evident. The measured result was 129 pCi/g, approximately 0.6% of the Westinghouse Hanford soil standard. This site has been a posted radiological control area.

4.3 VEGETATION SAMPLING RESULTS, 1989

4.3.1 Grid Site Vegetation Sampling

Thirty-three grid sites (which included five from the Grout Site) were sampled in 1989. Of these samples, all 33 sites demonstrated radionuclide concentrations (for at least one radionuclide) above regional background levels (PNL 1988). Radionuclide concentrations are listed by area in Tables E-4 and E-5.

4.3.1.1 Cesium-137 Results. The highest ^{137}Cs result was found at grid site 2W23, located east of the 241-U Tank farm in 200 West Area. The ^{137}Cs concentration there was 1.9 pCi/g, down from 5.2 pCi/g in 1988, about 120 times background.

4.3.1.2 Strontium-90 Results. The highest ^{90}Sr result was found at grid site 2E17, northwest of the 241-C Tank Farm in 200 East Area. The ^{90}Sr concentration was 7.2 pCi/g, down from 9.9 pCi/g in 1987 and about 170 times background.

4.3.1.3 Plutonium-239 Results. The highest ^{239}Pu result was found at grid site 2W33, south of the 241-S Tank Farm, in 200 West Area. The concentration there was 0.08 pCi/g, about 230 times background level.

4.3.2 Radionuclide Concentration Trends in Vegetation

There has been no statistically significant differences for the 200 Area averages for ^{137}Cs in vegetation from 1979 to the present. The yearly averages are illustrated in Figure E-10.

4.4 GRID SITE FECES SAMPLING, 1989

In 1984, the feces sampling procedure used for sampling at the grid sites was changed so that only fresh (about 1-yr-old) feces would be collected. This ensured that only the impact from the previous year would be apparent. In 1989, no grid site feces samples were collected.

4.5 SPECIAL SOIL SAMPLING, 1989

4.5.1 Soil Samples Analyzed for Herbicide Residue

Soil samples were taken from 23 underground radioactive materials sites in the 200 and 600 Areas to determine whether a herbicide buildup was occurring (see Table E-6 in Appendix E). Soil samples were analyzed for 2,4,5-T; 2,3,5TP; and 2,4,-D. All results were less than the detection limit of 1 μg/g, indicating that no herbicide buildup has occurred.

4.6 CONCLUSIONS

There are several potential sources of environmental contamination in the 200 Areas, including low-level waste disposal sites, tank farms, and processing facilities. Results from the fenceline sampling sites, in conjunction with the grid sampling sites and several animal transport incidents, continue to indicate that most environmental contamination originates from tank farms and related facilities. The major mechanism influencing the migration of radioactive material are the high winds from the southwest. The near-field environmental monitoring program in the Separations Area has been realigned to stress tank farms and to initiate corrective action (i.e., cleanup), thereby minimizing adverse environmental impact.

Results from vegetation samples collected in the 200 Areas demonstrate that radionuclide concentrations are slightly above regional background. These concentrations are attributed to root uptake from the contaminated soils and deposition. The surface stabilization program, initiated in 1979, has significantly reduced both the amount of contaminated vegetation and the level of radionuclides found in vegetation; however, some setbacks were observed in 1989.

5.0 EXTERNAL RADIATION MONITORING

5.1 INTRODUCTION

A network of thermoluminescent dosimeters (TLD) is positioned in and around the 200 Areas to monitor exposure rates from external radiation sources (primarily gamma rays). The TLD measurements are used to determine baseline exposure rates in the 200 Areas environment. From these baseline data, the contribution of Hanford Site activities can be discerned, and the potential dose due to external exposure to employees can be assessed. The TLDs measure dose-equivalent rates reported in mrem/yr at a specific location.

The environmental TLDs measure exposure rates resulting from all types of external radiation sources including cosmic radiation, naturally occurring radioactivity in air and soil, fallout from nuclear weapons testing, and contributions from Hanford Site activities.

Each TLD consists of three chips of calcium-fluoride/manganese (Harshaw TLD-400) encased in an opaque capsule lined with 0.025 cm of tantalum and 0.005 cm of lead. Each capsule is placed in a translucent, waterproof, plastic vial and is mounted about 3 ft above the ground. The TLDs are placed at each active grid site, at active and inactive surface-water disposal sites, and at PUREX Plant-related facilities (i.e., tank farms, active cribs, and the PUREX Plant fenceline). Four batches of capsules are used; two for the grid and surface-water sites and two for the PUREX Plant related facilities. These Capsules are exchanged each calendar quarter.

Each quarterly measurement is an average of the exposure received by the three chips in the same container. The response of the chips has been calibrated by the PNL Radiation Calibration Laboratory, and results are reported in terms of air dose.

5.2 RESULTS

The TLD data are listed in Tables F-1 through F-4 of Appendix F. Generally, all grid and surface-water sites have shown approximately a 10% increase in 1989. This overall increase is believed to be a result of fluctuations in regional background--not an actual increase in exposure due to Hanford Site operations (PNL 1989). One site at the PUREX Plant related facilities has displayed an upward trend since 1985.

5.2.1 Grid Sites

All grid sites are located outside radiological control areas and represent the general environment. The exposure rate measured at these sites did not change significantly from 1988. The range in 1989 was 86 to 194 mrem/yr as compared to 85 to 220 mrem/yr in 1988 (Elder et al. 1989). The sites that had levels elevated above background were attributed to nearby waste sites and/or to low-level contamination in the environment.

5.2.2 Surface-Water Sites

All TLDs at surface-water sites, except for West Lake, are within radiological control areas (see Section 6.0). Only three sites were slightly above background: the 216-B-63 Ditch, the 216-Z-19 Ditch, and the 216-B-3 Ditch. The highest exposure rate for surface-water sites in the Separations Area was at the 216-B-3 Ditch, with an exposure rate of 144 mrem/yr.

5.2.3 Plutonium-Uranium Extraction Plant-Related Facilities

Thermoluminescent dosimeters are located at several sites associated with the PUREX Plant operations, including tank farms, active cribs, and the PUREX Plant fenceline. These locations are shown in Figure F-1 of Appendix F. The only exposure rate significantly higher than the general Separations Area environment that could be attributable to the PUREX Plant operation was the rate observed at the 241-A Tank Farm complex. This facility, which receives high-level liquid waste from the PUREX Plant, had external radiation levels ranging from 28 to 2,400 mrem/yr. These high levels were localized and few in number (only four were significantly higher than the grid sites) and, therefore, had minimal environmental impact. All other TLD measurements at PUREX Plant related locations were consistent with levels seen in the general Separations Area environment.

5.2.4 External Radiation Trends

Since the TLD program was initiated in 1978, there has been no overall increase in radiation levels in the 200 Areas. In fact, there have been dramatic localized decreases due to decommissioning efforts. The average annual exposure rate at the grid sites in the 200 East Areas has remained consistent from year to year as compared to background data (See Figure F-2 in Appendix F). The annual average exposure rate at the grid sites in the 200 East Area was 103 mrem/yr and in the 200 West Area was 109 mrem/yr. The only PUREX Plant TLD site to display an upward trend was the 216-U-2 Crib #2, with a 14.2 mrem/yr/yr trend since 1985. The dose rates from this site will be closely monitored in the future.

5.3 CONCLUSIONS

In 1989, operations in the 200 Areas did not contribute significantly to the external exposure rate of the general environment. Consequently, the exposure rate in the 200 Areas was not significantly different from the exposure rate received offsite from natural sources of radiation. As expected, external radiation levels were elevated at certain grid sites, radiological control areas, and facilities, reflecting their proximity to radioactive waste management activities.

6.1 INTRODUCTION

Water, vegetation, and sediment samples were collected from active ponds and ditches in 1989. Ponds and ditches in the 200 Areas receive potentially contaminated wastewater from chemical processing plants and other facilities. All water is continuously sampled at the point of discharge to ensure compliance with internal company standards and applicable DOE standards. As an additional operational check, the 200 and 600 Areas Operational Environmental Surveillance Program collects water samples at the ponds and ditches. Sampling locations are shown in Figures G-1 and G-2 of Appendix G. Sources of liquid effluents are listed in Table G-1.

Water samples of 1 L are collected on a weekly basis from the active ponds and ditches. The pH is determined each week, then the samples are composited and analyzed monthly for total alpha, total beta, gamma-emitting radionuclides, and ^{90}Sr. Each site has replicate samples taken for 4 weeks, on a rotating basis. Additionally, a 1-L sample is collected on a quarterly basis from each site for nitrate analysis. Samples of aquatic vegetation are collected from ponds and ditches yearly to determine the root uptake of radionuclides from potentially contaminated sediments. Along with vegetation samples, sediment samples are collected to measure the accumulation of radionuclides. These samples consist of a composite of five plugs, each 900 cm^2 by 2.5 cm deep. Both the vegetation and sediments are analyzed for gamma-emitting radionuclides, ^{90}Sr, ^{239}Pu, and uranium.

6.2 RESULTS

6.2.1 Water

Results of water sampling at the ponds and ditches are summarized in Table G-2 of Appendix G. Because a large percentage of the results are less than the analytical detection limit, only the maximum and minimum concentrations at each site are presented. The only elevated gamma-emitting radionuclide was ^{137}Cs. The highest monthly ^{137}Cs result of 145 pCi/L, or 5% of the DCG, was observed at the south sample station at the 216-Z-21 Basin (See Appendix I). The highest ^{90}Sr concentration, 78 pCi/L or 8% of the DCG, was found at the third overflow of the 216-B-3 Pond.

6.2.2 Nonradiological Parameters

Results of nitrate and pH measurements are summarized in Table G-3 of Appendix G. The pH annual averages ranged from neutral to slightly basic. The highest annual average pH of 9.5 was found at West Lake, which is a natural, stagnant seep that receives no effluent. All of the nitrate results were less than the detection limit (approximately 1.2 p/m).

6.2.3 Vegetation

Nine vegetation samples were collected from eight ponds and ditches in 1989. Each sample consisted of growing stems and leaves from predominant plant species at each location. The vegetation was analyzed for gamma-emitting radionuclides, ^{90}Sr, ^{239}Pu, and uranium; the results are reported in Table G-4 of Appendix G.

6.2.4 Sediment

The results from sampling pond and ditch sediments are provided in Table G-5 of Appendix G. The highest ^{137}Cs result was found at the 216-T-4 Ditch. The concentration measured in 1989 was 1,660 pCi/g, or about 8% of the Hanford Site soil standard.

6.3 CONCLUSIONS

No significant increases in radioactivity were observed in ponds and ditches in 1989, and none of the levels exceeded the applicable standards. All surface waters associated with Separations Area operations were below the DCG for all radionuclides. The analytical results of vegetation samples reveal that, while there was some physiological uptake of radionuclides, the amounts were relatively insignificant. Analyzed sediment samples demonstrated elevated levels of mainly ^{137}Cs.

All ponds and ditches that receive potentially contaminated water are within posted radiological control areas.

7.0 RADIOLOGICAL SURVEYS

7.1 INTRODUCTION

Radiological surveys are conducted to determine changes in the radiological status of the 200 and 600 Areas environment. Trends in radiation levels or radiological contamination may (1) aid in assessing the adequacy of the waste containment of underground radioactive material, (2) indicate movement of radioactive material away from radiological control areas, or (3) detect releases that might otherwise go undetected. The frequency of surveys is based on site history, potential for contamination, and ease of access. The survey schedule is outlined in Table H-1 of Appendix H.

7.2 ROADS

A beta-gamma detector, mounted approximately 20 in. aboveground on the underside of a truck, is used to survey the 200 Areas road surfaces. The detector consists of four 1B85 Geiger-Muller tubes connected to a count-rate meter in the cab of the truck. All frequently traveled blacktop and improved roads and parking lots in and around the 200 Areas are surveyed bimonthly to detect the presence of radioactive material. Roads less frequently traveled, or with low contamination potential, are surveyed either quarterly or semiannually. Other roads on the Hanford Site are surveyed by PNL. No new contamination was detected on the roads in 1989.

7.3 PONDS AND DITCHES

Open pond and ditch banks are routinely surveyed to identify contamination at these sites. The thin-window, pancake-type Geiger-Muller probe with the BNW-1 count-rate meter is the principal instrument used in these surveys. Special survey plots are designated around the perimeters of these sites. They are marked with metal posts and numbered. Contaminated vegetation with a maximum reading of 60,000 counts/min was dredged from the 216-T-4 Ditch. No other significant contamination was detected in 1989.

7.4 DRY-WASTE DISPOSAL SITES

The retired dry-waste disposal sites are surveyed to detect radiological changes due to biological intrusion (indicative of loss of control). These sites are located in the 600 Area (see Figure H-1 of Appendix H) and in the 200 Areas (see Figures 1-1 and 1-3).

The posting status for regions 618-2, 618-3, and 618-7 was changed from "Surface Contamination" to "Underground Radioactive Material." A uranium slag reading 3,000 counts/min was found on region 618-4 as well as outside the site markers for this area. The area has been posted pending cleanup.

Three small areas of contamination reading 30,000 counts/min (max) and one small area of contamination reading 8,000 counts/min were reported at region 218-E-12B in 1989. Health Physics issued a Radiation Problem Report on these areas.

7.5 LOW-LEVEL LIQUID-WASTE DISPOSAL SITES

Low-level liquid-waste disposal sites, other than ponds and ditches, consist of cribs, French drains, reverse wells, trenches, and unplanned release sites. As with dry-waste disposal sites, liquid-waste sites are surveyed at least annually, and as often as quarterly, to detect changes in surface radiological conditions. The most significant results in 1989 are as follows.

7.5.1 216-B Sites

Contamination on and around the 216-B-43 through -50 Cribs continues to increase. The surface contamination zone has been extended to Baltimore Avenue on the east and to 12th Street on the north. The source of contamination may be migration from the adjacent UN-216-E-17.

Ant intrusion continues to be a problem at the 216-B-64 Retention Basin. Another eradication attempt will be made in spring 1990.

7.5.2 216-S Sites

Dense vegetation and soil contamination with readings of up to 2.5 mrem/h continue to be a problem. Hanford Restoration Operations has provided a tentative cleanup date of September 30, 1991.

7.5.3 216-T Sites

A large portion of the 216-T-14 through -17 Trenches are contaminated up to 400 counts/min. The source of this contamination appears to be migrating sand from the adjacent UN-216-W-31. The area has been reposted as "Surface Contamination," pending cleanup.

The zone around the 216-T-26-28 Cribs was extended. This area is scheduled for cleanup in 1990.

An increase in the amount of contamination was reported at the 216-T-34 Crib, with readings of up to 1.5 mrem/h. Although some of the contamination is not new, the amount of contamination found has increased.

7.5.4 216-U Sites

A contamination migration has been identified at the 216-U-1/-2 Cribs area. The contamination has been marked, and isolated, pending cleanup.

Two stabilized sites, the 216-U-10 Pond and the 216-U-11 Overflow Area, were found to have regions of contamination measuring up to 1,000 counts/min. Some cleanup at these sites has been achieved, but the areas have not yet been released.

7.5.5 216-Z Sites

Stabilization of regions 216-Z-4, 216-Z-6, 216-Z-10, and 216-Z-17 was accomplished in 1989.

7.5.6 Unplanned Release Sites

The most noteworthy contamination was found at the following unplanned release sites.

- The zone at UN-216-W-33, which contains contaminated vegetation over the underground pipeline from the 216-U-8 Crib to 224-U, has been extended to include newly found contaminated vegetation.
- A contamination migration has been identified at UN-216-E-5. This contamination is spreading to the north and to the east of the 241-B-154 Diversion Box, with levels of contamination ranging from 400 counts/min to 3 mrem/h. A Surveillance and Compliance Inspection Report (SCIR) has been issued for this site.
- Zone UN-216-E-17 appears to be spreading and now extends from Baltimore Avenue on the east to areas 216-B-43-50 and 216-B-57 to the west. This area is densely contaminated with radiation levels from 3,000 counts/min to 35 mrem/h. Cleanup is scheduled to begin in 1990.
- A stabilization effort was initiated for the UN-216-E-37 and UN-216-E-39 areas. The areas were scraped, and the contaminated soil was deposited in the 218-C-9 Trench. A final release survey and a posting status change are yet to be performed.

7.6 TANK FARM PERIMETERS

Tank farm perimeters and associated facilities are surveyed annually to detect any migration of contamination. Tank farms and related facilities are sources of environmental contamination. Recontamination of the same

fencelines year after year seems to be associated with the prevailing wind direction.

The south and east fencelines of the 241-B Farm and 241-BX-BY Farms continue to be a problem.

In the 200 West Area, the east fenceline of the SX Farm was expanded to the blacktop road. A sizable surface contamination area (UN-216-W-24) is adjacent to this fenceline.

The north fenceline of 241-U was extended because of contamination levels ranging from 300 counts/min to 15,000 counts/min.

The north and east fenceline contamination of 241-T Farm is adjacent to the migrating contamination of UN-216-W-31.

The schedule for cleanup of these areas has yet to be determined. It is planned that the interior of the tank farms will be cleaned up before cleaning up the fencelines. This will be done to prevent recontamination.

7.7 The BC CRIBS AND CONTROLLED AREA

The BC Cribs and Trenches (Figure H-2 in Appendix H) are a series of liquid-waste disposal sites that were active in the mid-1950's. In 1959, it was discovered that animals had burrowed into one trench and transported radioactivity over an area exceeding 2,500 acres. In 1979, special survey plots were established throughout the controlled area to monitor migration of the contamination. Data accumulated during the 10-yr period indicate that no significant migration of contamination has occurred. The cribs and trenches were surface stabilized in 1982.

The Mobile Surface Contamination Monitor (MSCM) semiannual survey report for May 1989 reveals no significant contamination (only a small area of 300 counts/min). The November semiannual survey was not available due to mechanical breakdown of the tractor.

Several areas of contamination, with levels ranging from 300 counts/min to 9,000 counts/min, were found while surveying the access roads and firebreaks. These contaminated areas resulted in the posting of all access roads as "Surface Contamination."

8.0 SPECIAL PROJECTS AND INVESTIGATIVE SURVEILLANCE

8.1 INTRODUCTION

Special projects in 1989 included soil analyses of waste disposal sites to determine any buildup of pesticide residues, review of the vegetation control program, and testing of engineered biological barriers with captive mammals to determine the effect of burrowing and water penetration on simulated waste sites.

Special investigative surveillances were conducted in the operations areas in 1989 to clarify conditions indicated by routine samples or survey results, or to determine the need for full scale characterization of a site. These surveillances are often performed to help answer questions that result from analyses of routine samples; however, they may also be the result of concerns about radiological or potentially hazardous waste because they affect or are affected by employee safety, biotic intrusion, maintenance of containment systems, or potential contamination migration. For example, special surveillances or samples may be collected from:

- A broader area when analytical results from one of the routine samples show elevated radionuclide content
- An area where scheduled construction activities in the vicinity of a waste site make it desirable to demonstrate the radiological condition on the area
- A site where biotic intrusion, such as animal burrows or deep-rooted vegetation, has created the potential for the spread of contaminants
- Sites where the integrity of waste maintenance systems is questioned.

These are examples, but not an all-inclusive list, of instances when special surveillances or samples are needed to ensure operational compliance with guidelines and regulations.

8.2 SAMPLE TYPES

Types of special samples in the past have included air, water, snow, sediments, soil, vegetation, animal excrement, and various whole animals such as spiders, ants, termites, birds, mice, coyotes, and bobcats. In 1989, special samples included soil, vegetation (tumbleweeds), pigeons (including feces), a raven, house mice (including nest and feces), and a swallow's nest.

8.3 METHODS

8.3.1 Soil Analyses for Pesticide Residue

Soil samples were collected at 23 waste sites that are routinely sprayed for vegetation control and the samples were sent to U.S. Testing Laboratory for herbicide residue analyses to determine if there was a need for widespread, routine analyses at all waste sites. The RCRA protocols were followed.

8.3.2 Vegetation Control

The effectiveness of the Vegetation Control Program on radioactive waste sites was determined by detection of contamination during routine radiological surveys of the waste sites. In addition, visual inspections of the waste sites were conducted to observe vegetative cover.

8.3.3 Animal Capture and Collection

A scientific collection permit (#101) was granted to Westinghouse Hanford in 1989 by the Washington Department of Wildlife to allow collection and salvage of selected animals for contamination analyses and testing engineered barriers. Methods of collection included live traps, snap (kill) traps, and the salvage of dead animals for laboratory analyses.

8.3.4 Laboratory Analyses

Field preparations of samples were done as outlined in routine sample-collection procedure manuals. Methods for exceptions of unusual samples (e.g., bobcat) not covered in a procedure manual were specified by the Environmental Protection fieldwork coordinator. Samples that had radioactivity levels significantly above background, as determined by field survey instruments, were sent to Westinghouse Hanford onsite analytical laboratories, and those near or below background levels were sent to the U.S. Testing Laboratory in Richland, Washington.

Samples were washed to remove external contamination prior to analyses. Vegetation samples occasionally included the entire plant, including roots if required. Animal samples of larger specimens, after being washed, were divided into portions to separate skin and fur or feathers, gastrointestinal organs, and muscle and bone.

8.4 RESULTS

8.4.1 Soil Pesticide Residue

Soil samples were collected from 23 sites in 1989, and analyzed for 2, 4, 5-T; 2, 3, 5-TP; and 2, 4-D pesticide residues. Pesticide levels were below detectable limits in all samples. In the future, ten different waste sites will be selected each year for pesticide analyses.

8.4.2 Vegetation Control

Vegetation control was noticeably less effective in 1989. This was determined to be due to the use of an herbicide (Telar) to which plants had gradually been developing a resistance and also to application equipment failure. The development of resistance to the herbicide was discovered by the manufacturer at the same time as the observations of the resistance at Hanford.

8.4.3 Animal Collection and Salvage

Animals captured or salvaged in 1989 included 43 specimens from 8 species. These included Townsend's ground squirrel (3), northern pocket gopher (4), deer mouse (24), Great Basin pocket mouse (6), bushy-tailed wood rat (1), Nuttall's cottontail (1), gopher snake (3), and western rattlesnake (1).

8.4.4 Biotic Radioactive Contamination

There were eight instances of tumbleweed (Salsola kali) contamination documented in the 200 Areas in 1989, one rabbit brush (Chrysothamnus sp.), and 1 big sagebrush (Artemisia tridentata). The contamination, as measured on field survey instruments (Geiger-Mueller meters equipped with a P-11 Probe), ranged from 400 counts/min to 5 mrem/h. There were three contaminated domestic pigeons captured (all from T Plant in the 200 West Area) with contamination ranging from 500 counts/min to 1,200 counts/min. A pigeon fecal sample from the submarine reactor burial trench in the 200 East Area measured slightly above background radiation. A dead raven with external contamination reading 1,000 counts/min on the head was found at B Plant. A barn swallow nest with radioactive contamination reading 2,000 counts/min was found at the 241-AX Tank Farm in 200 East Area. There are four contaminated house mice (three at REDOX and one at U Plant in the 200 West Area) reading from 800 counts/min to 10,000 counts/min external radiation. The total number and kinds of biota found to be contaminated with radioactivity were not unusual with the exception of a slight increase in contaminated vegetation.

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9.0 REFERENCES

AEC, 1974, *Measurements of Radionuclides in the Environment, Sampling and Analysis of Plutonium in Soil*, Nuclear Regulatory Guide 4.5, U.S. Atomic Energy Commission, Washington, D.C.

ANSI, 1975, *Performance, Testing, and Procedural Specifications for Thermoluminescence Dosimetry: Environmental Application*, ANSI-N545-1975, American National Standards Institute, Washington, D.C.

APHA, 1980, *Standard Methods for the Examination of Water and Waste Water*, 15th edition, American Public Health Association, Washington, D.C.

ASTM, 1976, *1976 Annual Book of ASTM Standards, Water*, Part 31, American Society for Testing and Materials, Philadelphia, Pennsylvania.

DOE, 1986, "Environmental, Safety, and Health Programs for DOE Operations," DOE Order 5480.1B, U.S. Department of Energy, Washington, D.C.

EML, 1972, *HASL-300 Procedures*, Environmental Measurements Laboratory, New York, New York.

Elder, R. E., A. W. Conklin, D. D. Brekke, G. W. Egert, and W. L. Osborne, 1986, *Rockwell Hanford Operations Environmental Surveillance Annual Report-Calendar Year 1985*, RHO-HS-SR-85-13 P, Rockwell Hanford Operations, Richland, Washington.

Elder, R. E., S. M. McKinney, and W. L. Osborne, 1989, Westinghouse Hanford Company Environmental Surveillance Annual Report--200/600 Areas, Calender Year 1988, Westinghouse Hanford Company, Richland, Washington.

EPA, 1979, *EPA Methods for Chemical Analysis of Water and Wastes*, EPA 600/4-79-020, Environmental Monitoring and Support Laboratory, U.S. Environmental Protection Agency, Cincinnati, Ohio.

Law, A. G. and R. M. Allen, 1984, *Results of the Separations Area Groundwater Monitoring Network for 1983*, RHO-RE-SR-84-24 P, Rockwell Hanford Operations, Richland, Washington.

NCRPM, 1976, *Environmental Radiation Measurements*, Report No. 50, National Council on Radiation Protection and Measurements, Washington, D.C. (December).

PNL, 1978, *The Hanford Environmental CaF_2:Mn Thermoluminescence Dosimetry*, PNL-2489, Pacific Northwest Laboratory, Richland, Washington (March).

PNL, 1989, *Hanford Site Environmental Report for Calendar Year 1988*, PNL-6825, Pacific Northwest Laboratory, Richland, Washington.

Smith, R. M., 1980, *216-B-5 Reverse Well Characterization Study*, RHO-ST-37, Rockwell Hanford Operations, Richland, Washington.

Van Luik, A. E. and R. M. Smith, 1982, *216-S-1 and S-2 Mixed Fission Product Crib Characterization Study*, RHO-ST-39, Rockwell Hanford Operations, Richland, Washington.

APPENDIX A

QUALITY ASSURANCE

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QUALITY ASSURANCE

Quality assurance (QA) may be defined as the actions necessary to ensure accuracy of a program. The Westinghouse Hanford Company (Westinghouse Hanford) environmental surveillance QA program consists of procedures and guides which demonstrate that environmental monitoring techniques and analyses are performed within established limits of acceptance. A sound QA program for environmental monitoring is essential to maintaining credibility.

Written operating procedures are an integral part of the Westinghouse Hanford environmental surveillance QA program. Procedures for field operations are provided in an internal Westinghouse Hanford manual. Emergency response and other special procedures may be documented separately. This appendix briefly describes the essential components of the Westinghouse Hanford environmental surveillance QA program.

DOCUMENTATION

Record keeping is a vital part of any environmental monitoring program. Maintenance of environmental data is not only important from a QA standpoint, but also from a regulatory point of view for trend analysis and for optimizing environmental monitoring procedures. For these reasons, each phase of the Westinghouse Hanford Operational Environmental Surveillance Program is documented. This documentation includes sampling logs, annual reports, and unusual occurrence reports.

SAMPLE REPLICATION

Replicate sampling and subsequent analysis are the primary means of assessing sample variability. Duplicate samples of air, water, soil, sediment, and vegetation are collected as part of the routine environmental surveillance program.

DATA ANALYSIS

Environmental data are reviewed to determine compliance with applicable federal and Westinghouse Hanford guidelines. The data are analyzed both graphically and statistically to determine trends and impacts on the environment. Newly acquired data are compared with historical data and background data. Routine environmental data are stored on both magnetic media (i.e., in a microcomputer environment) and on hardcopy printouts.

TRAINING

To ensure quality and consistency in sample collection and handling, all personnel performing such work receive formal training. All Westinghouse Hanford radiation protection technologists (RPT) are required to complete a

certification program through the Westinghouse Hanford Health Physics Department. In addition, those RPTs assigned to environmental programs receive special classroom orientation and on-the-job training by experienced personnel. Environmental Protection personnel receive training in such courses as "Radiation in the Environment," taught through the Tri-Cities University Center; courses taught at the Harvard School of Public Health; and various short courses.

SAMPLE FREQUENCY

The frequency of sample collection varies according to the importance of the measurement. Media sampled more frequently are critical in determining immediate releases to, or impacts on, the environment. A brief description of the sampling program is presented below.

1. Ambient air sample filters and water samples from active ponds and ditches are collected weekly.

2. Radiological surveys of 200 East Area and 200 West Area roads are performed on a monthly or bimonthly basis, as stated in Section 7.0.

3. The thermoluminescent dosimeters at grid sites, ponds, and ditches are exchanged quarterly.

4. Radiological surveys of waste sites are performed quarterly, semiannually, or annually depending on the importance, condition, and past history of the site.

5. Soil and vegetation samples are collected at the grid sites on an annual basis, as well as mud and vegetation samples from active ponds and ditches.

ANALYTICAL PROCEDURES

Three laboratories provide analytical support to the Westinghouse Hanford environmental surveillance program; these are the U.S. Testing Company, the Radiation Standards and Engineering Laboratory at Pacific Northwest Laboratory (PNL), and the Westinghouse Hanford 222-S Analytical Laboratory. The environmental samples are analyzed in accordance with prescribed procedures and quality control guides. The analytical procedures necessary to implement the environmental monitoring program are briefly described as follows and are listed according to the respective laboratory.

U.S. TESTING COMPANY

Much of the environmental surveillance program involves measuring radionuclide concentrations at or near background levels. These environmental measurements require a low detection limit and are typically performed at the U.S. Testing Company. This analytical laboratory routinely performs

analyses on soil, vegetation, animal feces, and air samples. Analyses are performed according to procedures and quality control guides described by the Environmental Measurements Laboratory (EML 1972), the U.S. Atomic Energy Commission (AEC 1974), and the National Council on Radiation Protection and Measurements (NCRPM 1976).

1. Air samples

a. Gamma energy analysis--Gamma-emitting radionuclides are measured by direct counting of the air sample filter with a hyperpure germanium (HPGE) detector. The gamma spectra is analyzed using a Nuclear Data 7700 software system.

b. Strontium--Airborne ^{89}Sr and ^{90}Sr are determined by leaching the composited air sample filters with nitric acid and then precipitating the isotope as a nitrate. The sample is purified by iron and barium scavenging. The final precipitate, strontium carbonate, is then counted for total beta (needed to set the ^{89}Sr value) with a low-background beta proportional counter. Both ^{89}Sr and ^{90}Sr are computer calculated from the resulting count data.

c. Plutonium--The various plutonium isotopes are leached from the air sample filter with nitric acid and passed through an ion-exchange resin. Further decontamination from lead, bismuth and other transuranics by washing with nitric and hydrochloric acids is performed. The plutonium is then eluted from the resin and electrodeposited on a stainless-steel disk, where it is counted using a surface barrier alpha spectrometer; data are collected on a Nuclear Data 7700 software system.

d. Uranium--Uranium is leached from the air sample filter and extracted as tetrapropyl ammonium uranyltrinitrate, followed by back extraction into water. The aqueous sample is then treated with sodium and lithium fluoride, and analyzed with a fluorometer to determine the mass uranium percentage.

2. Groundwater Samples

a. Total alpha and beta activity--The total activity due to alpha- and beta-emitting radionuclides is measured by directly counting the dried residue with a gas-flow proportional counter.

b. Strontium-90--The strontium is removed from the water sample by precipitating as a nitrate using nitric acid. The sample is purified by repeated scavenging with barium chromate and precipitating with barium carbonate. The strontium carbonate is then counted with a low-background gas-flow proportional counter.

c. Gamma energy analysis--Gamma-emitting radionuclides are analyzed by directly counting the water sample with a Ge(Li) detector equipped with a multichannel pulse height analyzer.

d. Tritium--Water samples are analyzed for ^{3}H by use of a liquid scintillation spectrometer.

e. Total uranium--Water samples are analyzed for total uranium by first treating with sodium and lithium fluoride and then analyzing with a fluorometer.

3. Soil Samples

a. Gamma energy analysis--Gamma-emitting radionuclides are measured using a Marinelli beaker and counting with a Ge(Li) detector equipped with a multichannel pulse height analyzer.

b. Strontium-90--The ^{90}Sr is removed from the soil sample by leaching the dried sample with nitric acid. The strontium in solution is converted to an oxalate, followed by precipitation as strontium carbonate. The carbonate is then deposited on a planchet and counted in the same manner as the ^{90}Sr water samples.

c. Technetium-99--The ^{99}Tc is isolated from other elements using hydroxide carbonate coprecipitation, which leaves the technetium in solution as the pertechnethe ion (TcO_4^-). Further purification is achieved by an anion-exchange column path, followed by liquid scintillation spectrometry.

4. Vegetation Samples

a. Gamma energy analysis--Gamma-emitting radionuclides are measured by direct counting of the sample with a Ge(Li) detector equipped with a multichannel pulse height analyzer.

Westinghouse Hanford 222-S Analytical Laboratory

The Westinghouse Hanford 222-S Laboratory also provides analytical support to the 200 and 600 Areas environmental surveillance program. This laboratory is the one normally utilized in emergency situations and for samples containing higher than normal environmental levels of radioactivity. Analytical procedures and quality control guides are described by the Environmental Measurements Laboratory (EML 1972), the American Society for Testing and Materials (ASTM 1976), the American Public Health Association (APHA 1980), and the U.S. Environmental Protection Agency (EPA 1979). A brief description of the routine analyses performed by the 222-S Laboratory is presented as follows.

1. Pond and Ditch Water

a. Total alpha and beta--An aliquot of the pond or ditch water is added to a stainless-steel dish and evaporated to dryness. The total alpha and beta activities are measured by direct counting with a gas-flow proportional counter.

b. Gamma energy analysis--The liquid sample is sealed inside a geometrically approved container. The gamma-emitting radionuclides are measured by direct counting with a Ge(Li) detector equipped with a multichannel analyzer.

c. Strontium-90--The ^{90}Sr is removed from the aqueous sample by precipitating the ^{90}Sr with barium carbonate. The strontium carbonate is purified by redissolving with nitric acid, precipitating as a nitrate, and precipitating once again as a carbonate. The ^{90}Sr activity is determined by beta counting with a gas-flow proportional counter.

d. Plutonium--Actinides are removed from the aqueous sample by precipitation with iron. The precipitate is redissolved in hydrochloric acid and the plutonium separated from the other actinides by ion exchange. The plutonium is electrodeposited on a planchet and counted using alpha spectrometry.

2. Pond and Ditch Mud and Sediment

a. Gamma energy analysis--The gamma-emitting radionuclides are measured by direct counting of the dried sediment sample using a Ge(Li) detector equipped with a multichannel analyzer.

b. Soil leach--Strontium, plutonium, americium, and other radionuclides are leached from the soil sample using a mixture of hydrochloric and nitric acids. The leachate is then analyzed for specific radionuclides, as with the liquid samples.

3. Pond and Ditch Vegetation

a. Gamma energy analysis--The liquid sample is sealed inside a geometrically approved container. The gamma-emitting radionuclides are measured by direct counting with a Ge(Li) detector equipped with a multichannel analyzer.

b. Vegetation leach--The vegetation samples are dry ashed in a furnace and then leached with a mixture of hydrochloric and nitric acids. The leachate is analyzed for specific radionuclides, as with the liquid samples.

Pacific Northwest Laboratory, Radiation Standards and Engineering Department

External Radiation (Thermoluminescent Dosimeters [TLD])--External radiation levels are measured using TLD. The TLD are located at all grid sampling sites, water sampling sites, and active tank farms and cribs associated with the PUREX Plant operation. The TLD (Harshaw TLD400) consist of three chips of calcium-fluoride/manganese encased in an opaque capsule lined with 0.025 cm of tantalum and 0.005 cm of lead.

The TLD are calibrated, packaged, and read by the PNL Radiation Calibration Laboratory, Radiation Standards and Engineering Department. All TLD work is performed in accordance with the procedures and specific guidelines of the American National Standards Institute (ANSI 1975) and PNL (1978).

APPENDIX B

GLOSSARY

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GLOSSARY

ACV	administrative control value
ALARA	as low as reasonably achievable
DCG	derived concentration guideline
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
PFP	Plutonium Finishing Plant
PNL	Pacific Northwest Laboratory
PUREX	Plutonium-Uranium Extraction (Plant)
QA	quality assurance
TLD	thermoluminescent dosimeters
UO_3	Uranium Oxide (Plant)
Westinghouse Hanford	Westinghouse Hanford Company

Aquifer--A subsurface formation consisting of sufficient saturated permeable material to yield significant quantities of water.

Confined aquifer--A subsurface water-bearing region having defined and relatively impermeable upper and lower boundaries.

Unconfined aquifer--An aquifer that has a water table or surface at atmospheric pressure.

Biological transport--Concerns one or more of the following processes:

- Movement of subsurface radioactivity to the surface by physiological plant processes
- Dispersion of such plants by the wind
- Contaminated urine and feces deposited by animals that have gained access to and ingested radioactivity
- Contaminated animals that have ingested radioactivity directly or ingested other contaminated animals or plants
- Physical displacement of radioactivity by burrowing animals
- Nests built using contaminated materials.

Background radiation--Refers to regional levels of radioactivity produced by sources other than those of specific interest (e.g., the nuclear activities at the Hanford Site).

Biota--The plant and animal life of a specific region.

Burial ground--An area specifically designated for the subsurface disposal and/or storage of solid, dry radioactive waste.

Chemical processing--The chemical treatment of material to selectively separate desired components. At the Hanford Site, plutonium, uranium, and fission products are chemically separated from irradiated fuels.

Control area--An area where access is controlled to protect individuals from extra exposure to radiation and radioactive materials.

Crib--A subsurface low-level liquid-waste disposal site that allows liquid waste to percolate into surrounding soil.

Decommissioning--The process of removing a facility or area from operation, often involving decontamination and/or disposal, plus incorporating appropriate controls and safeguards.

Decontamination--The removal of radioactivity from a surface or from within another material.

Environmental surveillance--A survey and sampling program designed to determine radiological impact due to site operations.

Groundwater--Water that exists below ground surface (i.e., within the zone of saturation).

Less than detectable--An analytical term for a radionuclide concentration in a sample that is lower than the minimum detection capabilities of that analytical equipment or process.

Operations--In this report, this term loosely refers to Westinghouse Hanford activities, including chemical processing, waste management, and decommissioning.

Percolation--Downward movement of water through the interstices of unsaturated rock or soil due to gravity or hydrostatic pressure.

Quality assurance--A program designed to maintain the quality of the results of a program within established limits of acceptance.

Radiation survey--Evaluation of an area or object with portable instruments to identify radioactive materials and radiation fields present.

Radiological control area--An area where access is controlled to protect individuals from exposure to radiation and/or radioactive materials. In the Separations Area, control areas include, but are not limited to, areas posted as Radiation Area, Surface Contamination, and Underground Radioactive Materials--all describing the radiological condition of the area within.

Radiological posting--Barriers, in the form of signs and chains, used to prevent access into a radiological control area.

Release from radiological posting--Removal of signs and chains when access to an area no longer needs to be restricted for radiological protection purposes.

Retired waste site--A waste site that is isolated and no longer available to receive waste in any form.

Separations Area--The primary area in the Hanford Site where chemical processing and most waste management activities are performed. It includes the 200 Areas and nearby 600 Area sites. Westinghouse Hanford is landlord of the Separations Area.

Surface contamination--A radiological control status that refers to radioactivity on the surface of the ground that exceeds the soil contamination standard.

Surface stabilization--A remedial action program on waste disposal sites that includes the addition of at least 4 ft of clean soil followed by revegetation. It is designed to cover surface contamination and inhibit biological transport.

Tank farm--An area of large underground tanks designed to store up to 1 Mgal each of high-level liquid waste.

Underground radioactive material--A radiological posting status where subsurface radioactivity is present, but where surface contamination is not in excess of the soil standards.

Unplanned release site--An area that was contaminated due to an unplanned release of radioactive contamination from a nearby source, making it a radiological control area.

Vadose zone--The unsaturated region of soil or the zone of aeration between the ground surface and the water table.

Thermoluminescent dosimeter--A chip or series of chips used for measuring external gamma radiation. It consists of a material capable of absorbing energy imparted by ionizing radiation, then emitting light as a result of thermal stimulation. A measure of that light is proportional to the radioactivity absorbed.

Waste management--The activity involved with storing, disposing, shipping, handling, and monitoring all radioactive waste.

Water table--The upper boundary of an unconfined aquifer below which saturated groundwater occurs.

Wind rose--A diagram illustrating the distribution of wind directions at a given location during a specific time. The diagram illustrates the direction from which the wind blows.

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APPENDIX C

AMBIENT AIR MONITORING FIGURES AND TABLES

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Figure C-1. The 200 East Area Showing Locations of Air Samplers.

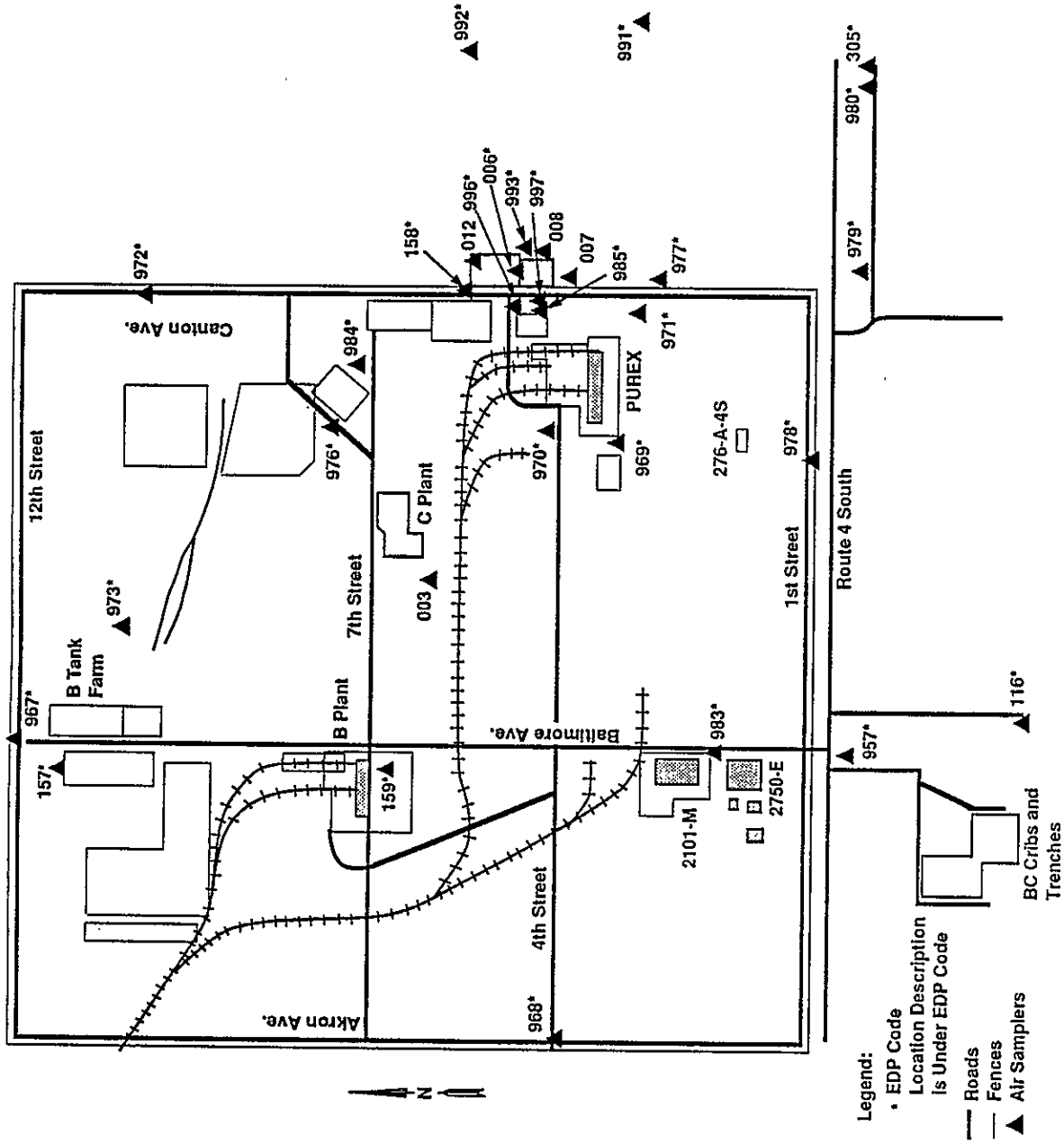


Figure C-2. The 200 West Area Showing Locations of Air Samplers.

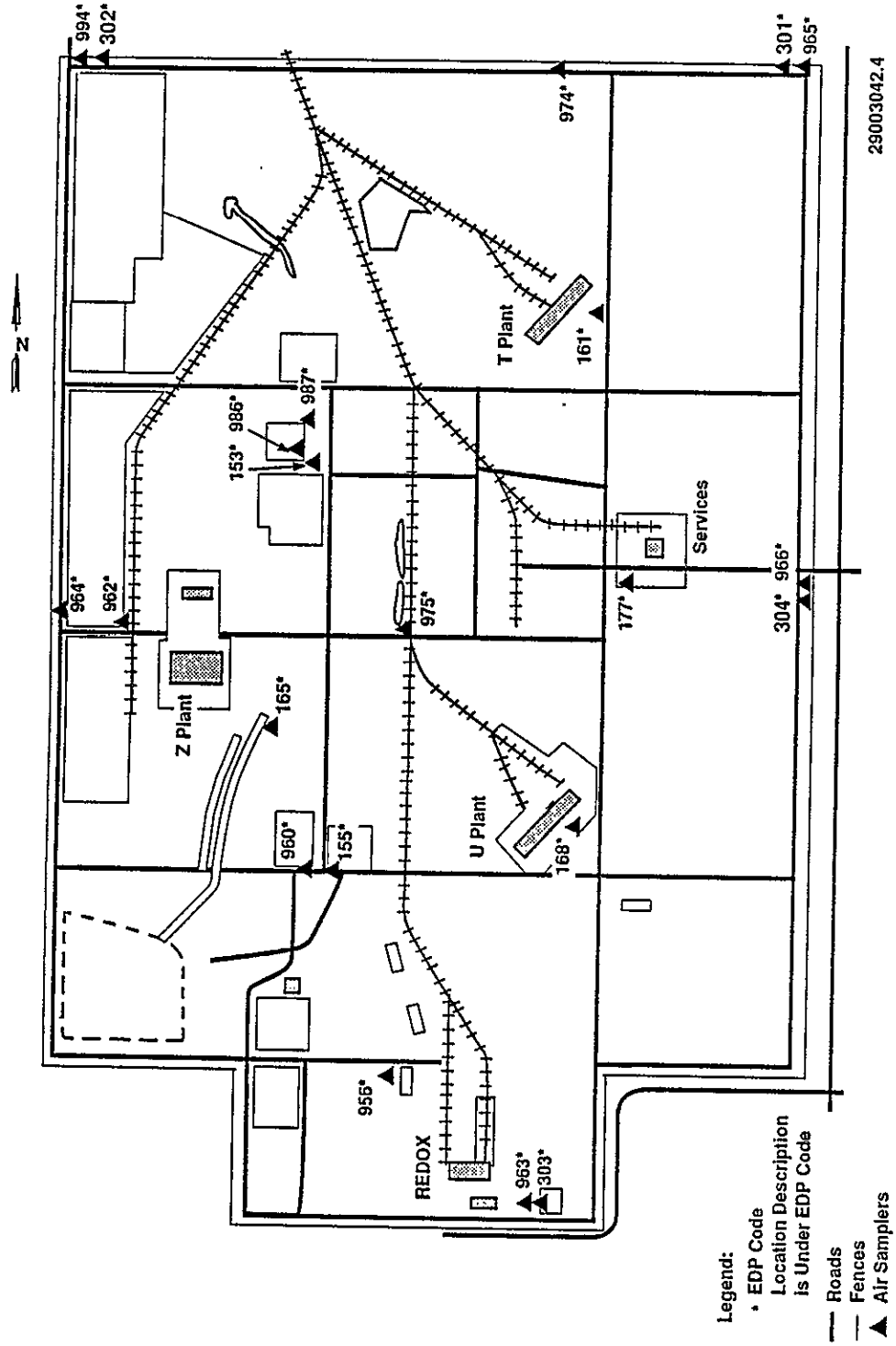


Figure C-3. Westinghouse Hanford Company Air Sampling Stations Away From the Separations Area.

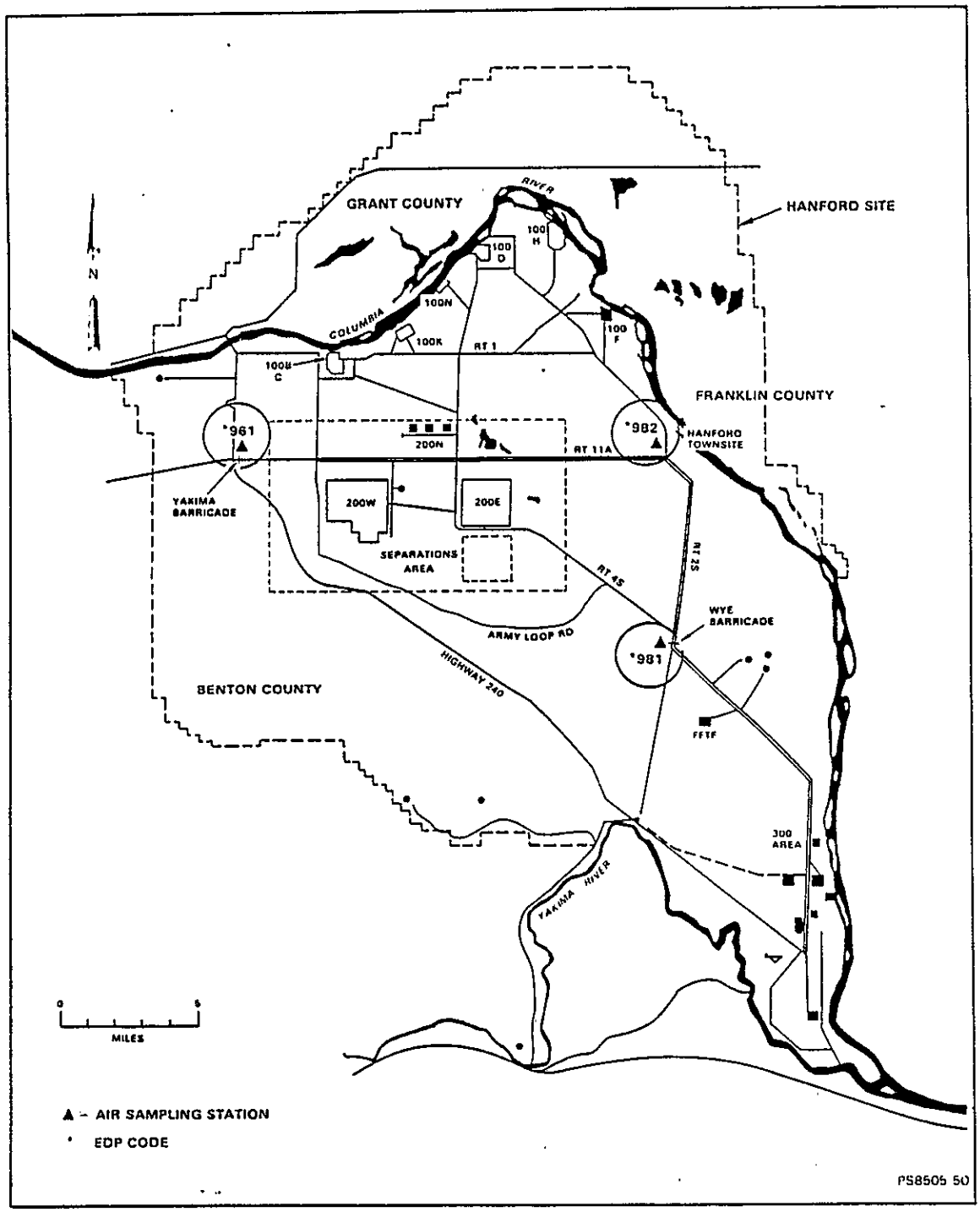


Table C-1.

AIR SAMPLES

EDP CODE	LOCATION
N003	SW of Hot Semi
N006	N of AP Tank Farm
N007	S of AP Tank Farm
N008	E of AP Tank Farm
N012	NE of 207-A Retention Basin
N116	BC Crib North
N153	TX Tank Farm
N155	U Tank Farm
N157	BY Tank Farm
N158	AX Tank Farm
N159	B Stack
N161	T Stack
N165	216-Z-19 Ditch
N168	U-Stack
N177	Laundry
N301	EMER. SITE next to N965
N302	EMER. SITE next to N994
N303	EMER. SITE next to N963
N304	EMER. SITE next to N966
N305	EMER. SITE next to N980
N956	E of S/SX Tank Farm
N957	BC Crib Area
N960	U tank Farm (rep)
N961	Yakima Barricade
N962	SE of 218-W-4B burial ground
N963	SE of Redox
N964	E of 218-W-4B burial ground
N965	NE corner 200W
N966	200W Main Gate
N967	N of B/BX Tank Farm
N968	200E west gate
N969	SW of Purex
N970	NW of Purex
N971	SE of Purex
N972	NE of C Tank Farm
N973	E of B Tank Farm
N974	N of T Plant
N975	E of Z Plant
N976	Grid Site 2E17
N977	Grid Site 2E30
N978	Grid Site 2E35
N979	Grid Site 2E36
N980	Grid Site 2EA
N981	WYE Barricade
N982	Hanford Townsite
N983	E of 2101M
N984	SE of C Tank Farm
N985	W of 272-AW
N987	NE of TY Tank Farm
N991	Grout Site SE
N992	Grout Site NE
N993	Grout Site NW
N994	Gate 609

Table C-2. Air Sample Results for 200 East/West Area in pCi/m^3 (1990). (sheet 1 of 6)

Site	Quarter	Sr-90	Error	Cs-137	Error	Pu-239	Error	U-Total	Error
N003	1	3.92E-04	+/- 1.64E-04	4.29E-04	+/- 4.67E-04	2.65E-06	+/- 2.66E-06	4.47E-05	+/- 2.89E-05
N003	2	9.37E-05	+/- 8.09E-05	-4.77E-05	+/- 3.77E-04	9.04E-07	+/- 5.08E-06	-0.00000	+/- 1.84E-05
N003	3	1.85E-04	+/- 1.19E-04	2.48E-04	+/- 3.92E-04	3.90E-06	+/- 3.26E-06	3.16E-05	+/- 1.58E-05
N003	4	3.80E-04	+/- 1.71E-04	-9.82E-06	+/- 5.02E-04	3.58E-06	+/- 2.79E-06	3.64E-05	+/- 1.74E-05
Average		2.63E-04	+/- 1.34E-04	1.55E-04	+/- 4.34E-04	2.76E-06	+/- 3.45E-06	2.72E-05	+/- 2.01E-05
N006	1	2.92E-04	+/- 1.46E-04	-1.21E-04	+/- 4.82E-04	1.06E-05	+/- 5.00E-06	3.02E-06	+/- 1.97E-05
N006	2	-0.00000	+/- 8.46E-05	4.07E-04	+/- 7.68E-04	1.50E-06	+/- 3.48E-06	5.48E-06	+/- 2.84E-05
N006	3		+/-		+/-		+/-		+/-
N006	4		+/-		+/-		+/-		+/-
Average		1.42E-04	+/- 1.15E-04	1.43E-04	+/- 6.25E-04	6.05E-06	+/- 4.24E-06	4.25E-06	+/- 2.41E-05
N007	1	1.31E-04	+/- 9.62E-05	9.64E-05	+/- 4.67E-04	1.54E-06	+/- 2.99E-06	1.13E-05	+/- 2.12E-05
N007	2	-0.00003	+/- 7.04E-05	-4.97E-05	+/- 7.98E-04	-0.00000	+/- 1.34E-06	-0.00000	+/- 2.47E-05
N007	3		+/-		+/-		+/-		+/-
N007	4		+/-		+/-		+/-		+/-
Average		4.73E-05	+/- 8.33E-05	2.33E-05	+/- 6.33E-04	7.25E-07	+/- 2.17E-06	5.50E-06	+/- 2.30E-05
N008	1	1.44E-04	+/- 8.85E-05	6.03E-04	+/- 3.86E-04	1.00E-05	+/- 4.65E-06	5.47E-05	+/- 2.92E-05
N008	2	-0.00000	+/- 7.75E-05	-1.63E-04	+/- 6.05E-04	6.56E-07	+/- 2.00E-06	7.58E-06	+/- 2.57E-05
N008	3		+/-		+/-		+/-		+/-
N008	4		+/-		+/-		+/-		+/-
Average		6.96E-05	+/- 8.30E-05	2.20E-04	+/- 4.95E-04	5.33E-06	+/- 3.33E-06	3.11E-05	+/- 2.75E-05
N012	1	-0.00000	+/- 6.66E-05	2.45E-04	+/- 5.33E-04	3.36E-06	+/- 3.06E-06	1.82E-05	+/- 2.47E-05
N012	2	5.00E-05	+/- 7.26E-05	7.97E-04	+/- 7.47E-04	-0.00000	+/- 1.35E-06	-0.00000	+/- 1.94E-05
N012	3	3.00E-05	+/- 5.30E-05	5.44E-05	+/- 5.71E-04	2.79E-06	+/- 3.50E-06	1.93E-05	+/- 1.35E-05
N012	4		+/-		+/-		+/-		+/-
Average		2.60E-05	+/- 6.41E-05	3.65E-04	+/- 6.17E-04	1.97E-06	+/- 2.64E-06	9.88E-06	+/- 1.92E-05
N116	1	1.72E-04	+/- 1.18E-04	1.00E-09	+/- 3.96E-04	1.06E-05	+/- 5.45E-06	1.42E-05	+/- 2.13E-05
N116	2	4.62E-05	+/- 9.12E-05	-4.98E-04	+/- 5.24E-04	6.05E-07	+/- 1.67E-06	-0.00000	+/- 1.84E-05
N116	3	3.34E-05	+/- 6.15E-05	2.18E-04	+/- 4.74E-04	8.67E-07	+/- 1.68E-06	4.39E-05	+/- 1.99E-05
N116	4	7.08E-05	+/- 7.31E-05	3.62E-04	+/- 4.24E-04	2.50E-06	+/- 2.50E-06	1.01E-04	+/- 3.72E-05
Average		8.06E-05	+/- 8.60E-05	2.05E-05	+/- 4.54E-04	3.64E-06	+/- 2.83E-06	3.86E-05	+/- 2.42E-05
N153	1	4.02E-05	+/- 9.53E-05	7.63E-04	+/- 5.26E-04	4.28E-06	+/- 3.11E-06	-0.00000	+/- 1.89E-05
N153	2	1.58E-05	+/- 8.92E-05	9.79E-04	+/- 5.93E-04	7.31E-06	+/- 4.58E-06	1.64E-06	+/- 1.97E-05
N153	3	1.27E-05	+/- 6.04E-05	1.96E-03	+/- 1.02E-03	4.52E-06	+/- 3.11E-06	6.38E-05	+/- 2.57E-05
N153	4	6.20E-05	+/- 7.06E-05	5.23E-04	+/- 5.46E-04	5.84E-06	+/- 3.45E-06	7.03E-05	+/- 2.81E-05
Average		3.27E-05	+/- 7.89E-05	1.06E-03	+/- 6.71E-04	5.49E-06	+/- 3.56E-06	3.39E-05	+/- 2.31E-05
N155	1	-0.00003	+/- 8.06E-05	1.46E-02	+/- 2.04E-03	6.65E-06	+/- 3.80E-06	2.39E-05	+/- 2.34E-05
N155	2	-0.00000	+/- 8.07E-05	5.63E-04	+/- 4.26E-04	1.38E-05	+/- 5.95E-06	1.36E-06	+/- 2.09E-05
N155	3	-0.00001	+/- 5.74E-05	1.05E-04	+/- 5.15E-04	2.12E-05	+/- 6.69E-06	6.06E-05	+/- 2.47E-05
N155	4	3.95E-06	+/- 5.62E-05	2.48E-04	+/- 6.51E-04	4.22E-05	+/- 9.95E-06	6.85E-05	+/- 2.71E-05
Average		-0.00001	+/- 6.87E-05	3.88E-03	+/- 9.08E-04	2.10E-05	+/- 6.60E-06	3.86E-05	+/- 2.40E-05
N157	1	1.13E-04	+/- 1.06E-04	4.79E-03	+/- 9.55E-04	3.09E-05	+/- 8.76E-06	1.04E-05	+/- 2.09E-05
N157	2	-0.00002	+/- 7.19E-05	9.18E-04	+/- 6.28E-04	5.09E-07	+/- 2.64E-06	-0.00000	+/- 1.92E-05
N157	3	6.11E-06	+/- 5.61E-05	2.02E-03	+/- 9.32E-04	-0.00000	+/- 1.15E-06	3.56E-05	+/- 1.76E-05
N157	4	6.27E-05	+/- 7.23E-05	1.76E-03	+/- 6.54E-04	2.24E-06	+/- 2.30E-06	5.80E-05	+/- 2.53E-05
Average		3.94E-05	+/- 7.66E-05	2.37E-03	+/- 7.92E-04	8.41E-06	+/- 3.71E-06	2.58E-05	+/- 2.07E-05

Note: Negative values indicate concentrations at or near background levels of radioactivity.

Table C-2. Air Sample Results for 200 East/West Area in pCi/m^3 (1990). (sheet 2 of 6)

Site	Quarter	Sr-90	Error	Cs-137	Error	Pu-239	Error	U-Total	Error
N158	1	1.58E-04	+/- 1.00E-04	7.31E-04	+/- 6.71E-04	2.37E-03	+/- 2.42E-04	-0.00000	+/- 1.88E-05
N158	2	6.68E-05	+/- 7.50E-05	9.79E-04	+/- 6.21E-04	3.06E-06	+/- 2.99E-06	1.10E-05	+/- 2.09E-05
N158	3	1.24E-03	+/- 3.33E-04	1.93E-03	+/- 9.69E-04	1.17E-06	+/- 2.03E-06	5.18E-05	+/- 2.21E-05
N158	4	4.57E-05	+/- 8.70E-05	1.39E-04	+/- 6.71E-04	4.21E-06	+/- 2.89E-06	9.43E-05	+/- 3.48E-05
Average		3.78E-04	+/- 1.49E-04	9.45E-04	+/- 7.33E-04	5.95E-04	+/- 6.25E-05	3.85E-05	+/- 2.42E-05
N159	1	7.31E-05	+/- 8.60E-05	4.56E-04	+/- 4.72E-04	9.85E-06	+/- 4.80E-06	-0.00000	+/- 2.03E-05
N159	2	2.95E-05	+/- 6.40E-05	2.32E-03	+/- 9.63E-04	1.22E-05	+/- 5.61E-06	7.10E-06	+/- 2.01E-05
N159	3	1.61E-05	+/- 6.76E-05	1.91E-05	+/- 6.24E-04	5.35E-06	+/- 3.93E-06	5.56E-05	+/- 2.37E-05
N159	4	1.35E-04	+/- 4.57E-04	1.14E-03	+/- 8.56E-04	7.02E-06	+/- 4.13E-06	3.73E-05	+/- 1.81E-05
Average		6.34E-05	+/- 1.69E-04	9.84E-04	+/- 7.29E-04	8.60E-06	+/- 4.62E-06	2.47E-05	+/- 2.06E-05
N161	1	1.38E-04	+/- 9.50E-05	8.50E-05	+/- 2.40E-04	6.25E-05	+/- 1.28E-05	-0.00000	+/- 1.84E-05
N161	2	-0.00001	+/- 5.30E-05	2.12E-04	+/- 4.30E-04	2.71E-05	+/- 8.90E-06	-0.00000	+/- 1.84E-05
N161	3	6.00E-05	+/- 7.89E-05	1.20E-04	+/- 5.88E-04	1.75E-05	+/- 6.36E-06	4.59E-05	+/- 2.02E-05
N161	4	-0.00002	+/- 7.69E-05	-1.44E-04	+/- 4.32E-04	4.21E-06	+/- 2.89E-06	3.02E-05	+/- 1.58E-05
Average		3.83E-05	+/- 7.60E-05	6.83E-05	+/- 4.22E-04	2.78E-05	+/- 7.74E-06	1.71E-05	+/- 1.82E-05
N165	1	1.70E-04	+/- 9.92E-05	-1.09E-04	+/- 4.03E-04	1.09E-05	+/- 4.91E-06	-0.00000	+/- 1.79E-05
N165	2	-0.00000	+/- 5.58E-05	2.44E-04	+/- 5.72E-04	2.84E-04	+/- 3.82E-05	3.22E-06	+/- 1.99E-05
N165	3	-0.00003	+/- 5.38E-05	4.46E-04	+/- 4.12E-04	2.67E-04	+/- 3.84E-05	1.69E-05	+/- 1.12E-05
N165	4	1.25E-04	+/- 1.07E-04	1.43E-04	+/- 4.20E-04	9.52E-05	+/- 1.71E-05	3.82E-05	+/- 1.81E-05
Average		6.46E-05	+/- 7.89E-05	1.81E-04	+/- 4.52E-04	1.64E-04	+/- 2.47E-05	1.30E-05	+/- 1.68E-05
N168	1	3.21E-05	+/- 6.30E-05	4.25E-04	+/- 6.81E-04	4.70E-06	+/- 3.33E-06	4.31E-05	+/- 2.83E-05
N168	2	4.49E-05	+/- 6.85E-05	7.89E-04	+/- 5.84E-04	3.37E-04	+/- 4.51E-05	1.59E-04	+/- 5.86E-05
N168	3	1.01E-05	+/- 5.16E-05	5.23E-04	+/- 5.85E-04	1.55E-04	+/- 2.45E-05	2.89E-04	+/- 8.84E-05
N168	4	-0.00002	+/- 5.01E-05	2.84E-04	+/- 4.53E-04	1.07E-05	+/- 5.31E-06	2.49E-04	+/- 7.90E-05
Average		1.56E-05	+/- 5.83E-05	5.05E-04	+/- 5.76E-04	1.27E-04	+/- 1.96E-05	1.85E-04	+/- 6.36E-05
N177	1	1.68E-05	+/- 6.19E-05	6.01E-04	+/- 6.16E-04	2.17E-05	+/- 7.00E-06	3.45E-05	+/- 2.63E-05
N177	2	2.77E-05	+/- 6.39E-05	-3.39E-04	+/- 6.16E-04	1.16E-04	+/- 1.97E-05	4.62E-05	+/- 2.89E-05
N177	3	4.94E-05	+/- 5.62E-05	4.85E-04	+/- 6.92E-04	5.94E-05	+/- 1.40E-05	2.93E-04	+/- 9.30E-05
N177	4	5.63E-05	+/- 6.69E-05	-2.10E-04	+/- 5.80E-04	2.66E-05	+/- 8.21E-06	1.80E-04	+/- 5.94E-05
Average		3.75E-05	+/- 6.22E-05	1.34E-04	+/- 6.26E-04	5.59E-05	+/- 1.22E-05	1.38E-04	+/- 5.19E-05
N950	1	-0.00003	+/- 4.83E-05	1.15E-04	+/- 4.29E-04	2.99E-06	+/- 2.72E-06	-0.00001	+/- 1.72E-05
N950	2	-0.00001	+/- 4.72E-05	-2.10E-04	+/- 5.03E-04	4.72E-07	+/- 1.50E-06	-0.00001	+/- 1.77E-05
N950	3	-0.00000	+/- 5.98E-05	2.92E-04	+/- 5.81E-04	-0.00000	+/- 1.19E-06	8.93E-06	+/- 9.59E-06
N950	4	-0.00002	+/- 4.90E-05	-1.03E-04	+/- 5.47E-04	5.50E-08	+/- 1.14E-06	2.36E-05	+/- 1.38E-05
Average		-0.00002	+/- 5.11E-05	2.35E-05	+/- 5.15E-04	5.97E-07	+/- 1.64E-06	3.32E-07	+/- 1.46E-05
N951	1	-0.00004	+/- 4.61E-05	3.86E-05	+/- 4.53E-04	-0.00000	+/- 1.43E-06	-0.00002	+/- 1.70E-05
N951	2	-0.00004	+/- 4.61E-05	2.10E-05	+/- 4.93E-04	5.50E-10	+/- 1.43E-06	6.58E-07	+/- 8.05E-06
N951	3	-0.00002	+/- 5.18E-05	1.87E-04	+/- 6.23E-04	-0.00000	+/- 2.10E-06	6.58E-07	+/- 8.05E-06
N951	4	-0.00000	+/- 7.75E-05	-3.04E-05	+/- 3.94E-04	5.00E-09	+/- 1.00E-06	6.58E-07	+/- 8.05E-06
Average		-0.00003	+/- 5.54E-05	5.40E-05	+/- 4.91E-04	-0.00000	+/- 1.49E-06	-0.00000	+/- 1.03E-05
N956	1	2.82E-04	+/- 1.29E-04	1.63E-03	+/- 4.62E-04	1.75E-06	+/- 2.09E-06	-0.00000	+/- 2.09E-05
N956	2	9.20E-05	+/- 9.32E-05	8.68E-04	+/- 6.71E-04	4.07E-06	+/- 3.28E-06	3.74E-06	+/- 2.03E-05
N956	3	1.26E-05	+/- 4.94E-05	-2.86E-05	+/- 6.53E-04	1.95E-06	+/- 2.54E-06	3.62E-05	+/- 1.73E-05
N956	4	1.30E-05	+/- 5.78E-05	4.62E-04	+/- 3.92E-04	8.03E-06	+/- 3.99E-06	1.81E-05	+/- 1.36E-05
Average		9.99E-05	+/- 8.23E-05	7.33E-04	+/- 5.45E-04	3.95E-06	+/- 2.97E-06	1.43E-05	+/- 1.80E-05

Table C-2. Air Sample Results for 200 East/West Area in pCi/m^3 (1990). (sheet 3 of 6)

Site Quarter	Sr-90	Error	Cs-137	Error	Pu-239	Error	U-Total	Error
N957 1	2.30E-04	+/- 1.14E-04	-3.37E-05	+/- 5.41E-04	3.69E-06	+/- 3.05E-06	1.89E-05	+/- 2.29E-05
N957 2	-0.00000	+/- 5.48E-05	5.97E-04	+/- 5.06E-04	3.83E-08	+/- 1.23E-06	3.81E-06	+/- 1.96E-05
N957 3	-0.00003	+/- 4.56E-05	-3.15E-04	+/- 2.70E-04	1.99E-07	+/- 2.65E-06	5.14E-05	+/- 2.24E-05
N957 4	2.59E-05	+/- 6.20E-05	4.96E-05	+/- 5.21E-04	8.99E-07	+/- 1.38E-06	1.89E-05	+/- 1.35E-05
Average	5.51E-05	+/- 6.91E-05	7.45E-05	+/- 4.60E-04	1.21E-06	+/- 2.08E-06	2.33E-05	+/- 1.96E-05
N960 1	2.06E-04	+/- 1.12E-04	4.70E-04	+/- 6.16E-04	8.90E-06	+/- 4.56E-06	3.27E-05	+/- 2.58E-05
N960 2	-0.00002	+/- 4.97E-05	1.10E-04	+/- 5.41E-04	1.10E-05	+/- 5.17E-06	2.39E-05	+/- 2.36E-05
N960 3	-0.00004	+/- 4.66E-05	8.95E-04	+/- 7.43E-04	4.20E-05	+/- 9.88E-06	5.10E-05	+/- 2.27E-05
N960 4	1.13E-04	+/- 7.80E-05	-2.67E-04	+/- 5.61E-04	2.81E-05	+/- 8.08E-06	3.65E-05	+/- 1.76E-05
Average	6.37E-05	+/- 7.16E-05	3.02E-04	+/- 6.15E-04	2.25E-05	+/- 6.92E-06	3.60E-05	+/- 2.24E-05
N961 1	4.78E-05	+/- 9.39E-05	6.25E-04	+/- 4.54E-04	1.17E-03	+/- 1.23E-04	8.37E-06	+/- 2.05E-05
N961 2	-0.00000	+/- 8.42E-05	-1.45E-04	+/- 4.09E-04	7.97E-06	+/- 4.23E-06	-0.00000	+/- 1.84E-05
N961 3	-0.00001	+/- 5.79E-05	-3.87E-04	+/- 6.14E-04	4.22E-07	+/- 1.42E-06	3.84E-05	+/- 1.87E-05
N961 4	1.02E-04	+/- 1.23E-04	1.57E-04	+/- 4.61E-04	-0.00000	+/- 2.19E-06	3.49E-05	+/- 1.83E-05
Average	3.21E-05	+/- 8.97E-05	6.25E-05	+/- 4.85E-04	2.95E-04	+/- 3.27E-05	1.89E-05	+/- 1.90E-05
N962 1	7.79E-05	+/- 1.47E-04	4.71E-04	+/- 9.81E-04	7.34E-06	+/- 5.06E-06	1.18E-05	+/- 3.32E-05
N962 2	1.61E-03	+/- 4.57E-04	3.45E-03	+/- 1.09E-03	1.19E-04	+/- 2.09E-05	7.65E-07	+/- 2.08E-05
N962 3	6.14E-04	+/- 2.10E-04	6.00E-04	+/- 8.16E-04	5.19E-05	+/- 1.11E-05	4.90E-05	+/- 2.12E-05
N962 4	1.25E-04	+/- 1.21E-04	4.16E-04	+/- 4.25E-04	1.50E-05	+/- 6.10E-06	8.50E-05	+/- 3.35E-05
Average	6.07E-04	+/- 2.34E-04	1.23E-03	+/- 8.28E-04	4.83E-05	+/- 1.08E-05	3.66E-05	+/- 2.72E-05
N963 1	2.34E-05	+/- 9.11E-05	1.85E-04	+/- 6.16E-04	2.20E-06	+/- 2.28E-06	5.29E-05	+/- 4.17E-05
N963 2	1.10E-05	+/- 7.58E-05	3.64E-04	+/- 5.95E-04	7.00E-06	+/- 3.99E-06	3.77E-06	+/- 2.00E-05
N963 3	2.58E-05	+/- 6.39E-05	-3.82E-04	+/- 5.47E-04	1.01E-05	+/- 4.80E-06	2.22E-05	+/- 1.37E-05
N963 4	9.65E-06	+/- 8.24E-05	3.11E-04	+/- 4.61E-04	9.99E-06	+/- 4.98E-06	6.28E-05	+/- 2.63E-05
Average	1.75E-05	+/- 7.83E-05	1.20E-04	+/- 5.55E-04	7.32E-06	+/- 4.01E-06	3.54E-05	+/- 2.54E-05
N964 1	1.83E-04	+/- 1.21E-04	-2.41E-04	+/- 6.15E-04	7.30E-06	+/- 4.28E-06	5.48E-07	+/- 1.92E-05
N964 2	1.25E-05	+/- 7.32E-05	3.57E-04	+/- 3.65E-04	3.65E-06	+/- 2.85E-06	6.48E-06	+/- 2.03E-05
N964 3	-0.00001	+/- 5.61E-05	-1.14E-04	+/- 6.08E-04	3.97E-06	+/- 3.07E-06	5.38E-05	+/- 2.33E-05
N964 4	1.42E-04	+/- 1.11E-04	4.10E-04	+/- 5.70E-04	1.61E-05	+/- 6.03E-06	5.07E-05	+/- 2.23E-05
Average	8.19E-05	+/- 9.03E-05	1.03E-04	+/- 5.40E-04	7.75E-06	+/- 4.06E-06	2.79E-05	+/- 2.13E-05
N965 1	2.08E-04	+/- 1.11E-04	-2.86E-04	+/- 5.73E-04	1.20E-06	+/- 2.07E-06	4.02E-06	+/- 1.98E-05
N965 2	1.15E-04	+/- 8.26E-05	-3.38E-04	+/- 6.15E-04	2.30E-06	+/- 2.73E-06	6.19E-08	+/- 2.01E-05
N965 3	-0.00001	+/- 5.31E-05	-2.00E-04	+/- 4.04E-04	4.84E-07	+/- 2.11E-06	2.65E-05	+/- 1.49E-05
N965 4	4.57E-05	+/- 7.64E-05	-4.86E-04	+/- 5.68E-04	2.46E-06	+/- 5.01E-06	2.89E-05	+/- 1.67E-05
Average	8.82E-05	+/- 8.08E-05	-3.27E-04	+/- 5.40E-04	1.61E-06	+/- 2.98E-06	1.49E-05	+/- 1.79E-05
N966 1	1.36E-04	+/- 1.05E-04	1.79E-04	+/- 4.62E-04	1.94E-06	+/- 2.52E-06	4.50E-05	+/- 2.85E-05
N966 2	-0.00002	+/- 5.02E-05	4.05E-04	+/- 5.06E-04	3.50E-06	+/- 3.04E-06	-0.00000	+/- 1.96E-05
N966 3	-0.00002	+/- 5.75E-05	1.05E-04	+/- 5.14E-04	8.03E-06	+/- 4.26E-06	4.75E-05	+/- 2.07E-05
N966 4	1.31E-04	+/- 9.47E-05	-1.33E-04	+/- 4.02E-04	-0.00000	+/- 3.99E-06	5.23E-05	+/- 2.32E-05
Average	5.39E-05	+/- 7.68E-05	1.39E-04	+/- 4.71E-04	2.86E-06	+/- 3.45E-06	3.62E-05	+/- 2.30E-05
N967 1	3.52E-04	+/- 1.42E-04	8.19E-04	+/- 5.17E-04	9.39E-07	+/- 1.76E-06	5.94E-06	+/- 2.00E-05
N967 2	1.41E-06	+/- 6.33E-05	5.70E-04	+/- 5.19E-04	-0.00000	+/- 1.42E-06	-0.00000	+/- 1.90E-05
N967 3	6.79E-06	+/- 6.15E-05	3.74E-04	+/- 6.60E-04	1.55E-06	+/- 1.89E-06	3.02E-05	+/- 1.57E-05
N967 4	2.60E-05	+/- 6.82E-05	7.69E-04	+/- 6.01E-04	9.67E-07	+/- 1.47E-06	4.07E-05	+/- 1.94E-05
Average	9.66E-05	+/- 8.38E-05	6.33E-04	+/- 5.74E-04	7.24E-07	+/- 1.64E-06	1.94E-05	+/- 1.85E-05

Table C-2. Air Sample Results for 200 East/West Area in pCi/m³ (1990). (sheet 4 of 6)

Site Quarter	Sr-90	Error	Cs-137	Error	Pu-239	Error	U-Total	Error
N968 1	7.89E-05	+/- 7.85E-05	-5.88E-04	+/- 6.38E-04	2.67E-06	+/- 2.68E-06	7.40E-06	+/- 2.11E-05
N968 2	7.35E-06	+/- 5.50E-05	2.29E-04	+/- 4.59E-04	-0.00000	+/- 1.65E-06	6.31E-06	+/- 2.03E-05
N968 3	-0.00003	+/- 5.57E-05	1.00E-04	+/- 4.87E-04	2.08E-06	+/- 2.17E-06	6.99E-05	+/- 2.74E-05
N968 4	-0.00000	+/- 6.10E-05	-4.34E-04	+/- 5.29E-04	5.77E-07	+/- 1.29E-06	6.24E-05	+/- 2.48E-05
Average	9.98E-06	+/- 6.26E-05	-1.73E-04	+/- 5.28E-04	1.19E-06	+/- 1.95E-06	3.65E-05	+/- 2.34E-05
N969 1	1.27E-04	+/- 8.84E-05	-3.05E-05	+/- 6.27E-04	9.72E-06	+/- 5.01E-06	2.07E-06	+/- 2.05E-05
N969 2	5.47E-05	+/- 7.38E-05	1.56E-04	+/- 6.32E-04	4.64E-07	+/- 1.55E-06	1.26E-05	+/- 2.33E-05
N969 3	1.30E-03	+/- 3.63E-04	2.07E-04	+/- 7.11E-04	2.89E-06	+/- 2.44E-06	2.87E-05	+/- 1.49E-05
N969 4	2.85E-05	+/- 6.42E-05	2.50E-04	+/- 5.21E-04	1.04E-06	+/- 2.19E-06	4.44E-05	+/- 2.07E-05
Average	3.78E-04	+/- 1.47E-04	1.46E-04	+/- 6.23E-04	3.53E-06	+/- 2.80E-06	2.19E-05	+/- 1.99E-05
N970 1	6.52E-05	+/- 7.37E-05	4.78E-04	+/- 5.50E-04	4.45E-05	+/- 1.07E-05	1.81E-05	+/- 2.33E-05
N970 2	9.14E-05	+/- 7.72E-05	6.00E-05	+/- 6.68E-04	7.79E-06	+/- 4.14E-06	1.28E-05	+/- 2.15E-05
N970 3	-0.00003	+/- 5.70E-05	1.90E-04	+/- 6.44E-04	1.88E-05	+/- 6.38E-06	4.67E-05	+/- 2.06E-05
N970 4	9.79E-05	+/- 7.94E-05	-2.74E-04	+/- 5.85E-04	1.04E-06	+/- 2.67E-06	4.00E-05	+/- 1.92E-05
Average	5.45E-05	+/- 7.18E-05	1.14E-04	+/- 6.12E-04	1.80E-05	+/- 5.97E-06	2.94E-05	+/- 2.11E-05
N971 1	1.50E-04	+/- 9.09E-05	6.35E-04	+/- 3.88E-04	1.76E-04	+/- 2.52E-05	1.01E-05	+/- 2.14E-05
N971 2	7.50E-04	+/- 2.41E-04	-4.15E-04	+/- 7.06E-04	1.85E-06	+/- 2.19E-06	1.97E-05	+/- 2.33E-05
N971 3	1.49E-05	+/- 6.12E-05	-6.86E-04	+/- 5.58E-04	2.49E-06	+/- 2.31E-06	4.75E-05	+/- 2.08E-05
N971 4	2.98E-04	+/- 1.29E-04	2.05E-04	+/- 4.02E-04	4.29E-07	+/- 1.66E-06	7.16E-05	+/- 2.79E-05
Average	3.03E-04	+/- 1.31E-04	-6.52E-05	+/- 5.14E-04	4.52E-05	+/- 7.84E-06	3.72E-05	+/- 2.34E-05
N972 1	2.44E-04	+/- 1.14E-04	1.08E-03	+/- 7.66E-04	1.92E-05	+/- 6.56E-06	3.85E-05	+/- 2.76E-05
N972 2	1.12E-04	+/- 8.31E-05	3.00E-05	+/- 6.94E-04	-0.00000	+/- 4.97E-07	1.27E-05	+/- 2.17E-05
N972 3	-0.00000	+/- 6.54E-05	3.91E-04	+/- 5.76E-04	9.86E-07	+/- 1.50E-06	7.95E-05	+/- 2.99E-05
N972 4	1.07E-04	+/- 8.38E-05	4.92E-04	+/- 4.37E-04	2.00E-06	+/- 2.91E-06	5.34E-05	+/- 2.39E-05
Average	1.15E-04	+/- 8.66E-05	4.98E-04	+/- 6.18E-04	5.36E-06	+/- 2.87E-06	4.60E-05	+/- 2.58E-05
N973 1	1.83E-04	+/- 1.03E-04	-6.81E-05	+/- 4.84E-04	9.88E-04	+/- 1.06E-04	5.13E-06	+/- 2.03E-05
N973 2	1.87E-04	+/- 1.05E-04	4.58E-04	+/- 4.31E-04	1.03E-06	+/- 1.87E-06	-0.00000	+/- 1.94E-05
N973 3	5.78E-07	+/- 8.39E-05	1.06E-03	+/- 6.94E-04	1.32E-06	+/- 2.76E-06	5.96E-05	+/- 2.43E-05
N973 4	1.68E-04	+/- 1.00E-04	2.68E-04	+/- 4.70E-04	2.12E-06	+/- 2.20E-06	4.70E-05	+/- 2.16E-05
Average	1.35E-04	+/- 9.80E-05	4.29E-04	+/- 5.20E-04	2.48E-04	+/- 2.82E-05	2.72E-05	+/- 2.14E-05
N974 1	2.88E-04	+/- 1.24E-04	8.50E-05	+/- 3.67E-04	-0.00000	+/- 2.18E-06	4.56E-06	+/- 2.03E-05
N974 2	1.56E-05	+/- 6.23E-05	3.96E-04	+/- 5.67E-04	2.35E-06	+/- 2.42E-06	2.85E-06	+/- 2.05E-05
N974 3	-0.00004	+/- 5.43E-05	1.18E-04	+/- 5.70E-04	1.42E-06	+/- 2.82E-06	1.82E-05	+/- 1.22E-05
N974 4	-0.00001	+/- 5.68E-05	3.28E-04	+/- 4.39E-04	2.95E-06	+/- 2.48E-06	4.22E-05	+/- 1.99E-05
Average	6.05E-05	+/- 7.44E-05	2.32E-04	+/- 4.86E-04	1.54E-06	+/- 2.48E-06	1.70E-05	+/- 1.82E-05
N975 1	2.04E-04	+/- 1.07E-04	5.96E-05	+/- 5.20E-04	1.55E-05	+/- 6.19E-06	2.97E-05	+/- 2.52E-05
N975 2	2.00E-05	+/- 9.09E-05	2.83E-04	+/- 5.63E-04	1.16E-05	+/- 5.18E-06	2.21E-06	+/- 1.97E-05
N975 3	-0.00003	+/- 5.45E-05	-2.00E-04	+/- 6.93E-04	1.02E-05	+/- 5.63E-06	4.14E-05	+/- 1.92E-05
N975 4	9.58E-05	+/- 7.78E-05	-1.91E-05	+/- 4.33E-04	1.94E-05	+/- 6.77E-06	7.98E-05	+/- 3.02E-05
Average	7.01E-05	+/- 8.26E-05	3.09E-05	+/- 5.52E-04	1.42E-05	+/- 5.94E-06	3.83E-05	+/- 2.36E-05
N976 1	4.36E-04	+/- 1.74E-04	-4.23E-05	+/- 5.76E-04	1.99E-06	+/- 2.97E-06	6.35E-05	+/- 3.40E-05
N976 2	3.56E-05	+/- 8.79E-05	-2.28E-04	+/- 5.41E-04	-0.00000	+/- 4.89E-07	-0.00000	+/- 1.86E-05
N976 3	1.16E-04	+/- 8.42E-05	7.00E-04	+/- 6.20E-04	-0.00000	+/- 3.28E-06	6.38E-05	+/- 2.60E-05
N976 4	2.43E-04	+/- 1.17E-04	5.26E-04	+/- 4.67E-04	1.93E-06	+/- 2.27E-06	2.21E-04	+/- 7.04E-05
Average	2.08E-04	+/- 1.16E-04	2.39E-04	+/- 5.51E-04	2.44E-07	+/- 2.25E-06	8.57E-05	+/- 3.73E-05

Table C-2. Air Sample Results for 200 East/West Area in pCi/m^3 (1990). (sheet 5 of 6)

Site Quarter	Sr-90	Error	Cs-137	Error	Pu-239	Error	U-Total	Error
N977 1	6.43E-05	+/- 9.51E-05	-1.16E-04	+/- 5.42E-04	6.83E-06	+/- 4.18E-06	4.15E-05	+/- 2.80E-05
N977 2	1.07E-04	+/- 9.90E-05	-1.15E-04	+/- 5.38E-04	1.33E-06	+/- 1.93E-06	9.56E-06	+/- 2.10E-05
N977 3	-0.00003	+/- 1.07E-04	3.69E-04	+/- 4.77E-04	2.48E-07	+/- 1.64E-06	7.42E-05	+/- 2.90E-05
N977 4	-0.00004	+/- 7.12E-05	-3.87E-04	+/- 6.14E-04	2.02E-06	+/- 2.08E-06	1.27E-04	+/- 4.35E-05
Average	2.19E-05	+/- 9.31E-05	-6.22E-05	+/- 5.43E-04	2.61E-06	+/- 2.46E-06	6.31E-05	+/- 3.04E-05
N978 1	2.06E-04	+/- 1.20E-04	2.70E-04	+/- 4.26E-04	5.95E-07	+/- 2.85E-06	5.83E-05	+/- 3.27E-05
N978 2	8.88E-05	+/- 1.02E-04	4.82E-05	+/- 5.06E-04	1.33E-06	+/- 1.92E-06	-0.00000	+/- 1.89E-05
N978 3	-0.00002	+/- 5.62E-05	4.62E-04	+/- 5.71E-04	7.23E-07	+/- 1.85E-06	3.38E-05	+/- 1.76E-05
N978 4	5.14E-05	+/- 8.98E-05	-1.29E-04	+/- 4.79E-04	9.66E-06	+/- 4.56E-06	9.77E-05	+/- 3.63E-05
Average	7.98E-05	+/- 9.20E-05	1.63E-04	+/- 4.96E-04	3.08E-06	+/- 2.79E-06	4.68E-05	+/- 2.64E-05
N979 1	3.03E-04	+/- 1.41E-04	1.20E-04	+/- 5.38E-04	7.54E-06	+/- 4.41E-06	4.27E-05	+/- 2.88E-05
N979 2	4.55E-05	+/- 6.86E-05	2.01E-04	+/- 3.72E-04	-0.00000	+/- 1.04E-06	-0.00000	+/- 1.83E-05
N979 3	-0.00004	+/- 1.14E-04	-4.98E-04	+/- 6.38E-04	-0.00000	+/- 1.45E-06	3.78E-05	+/- 1.85E-05
N979 4	5.02E-06	+/- 8.05E-05	1.03E-05	+/- 6.25E-04	4.60E-07	+/- 1.07E-06	3.50E-05	+/- 1.69E-05
Average	7.78E-05	+/- 1.01E-04	-4.17E-05	+/- 5.43E-04	1.42E-06	+/- 1.99E-06	2.72E-05	+/- 2.06E-05
N980 1	3.82E-04	+/- 2.11E-04	3.77E-04	+/- 6.66E-04	9.31E-04	+/- 1.05E-04	1.94E-05	+/- 2.36E-05
N980 2	-0.00000	+/- 5.74E-05	-1.35E-04	+/- 5.01E-04	-0.00000	+/- 1.36E-06	-0.00000	+/- 1.82E-05
N980 3	2.79E-05	+/- 9.61E-05	-1.04E-04	+/- 5.55E-04	7.81E-07	+/- 1.92E-06	4.90E-05	+/- 2.22E-05
N980 4	1.70E-06	+/- 7.39E-05	2.50E-04	+/- 5.21E-04	2.12E-06	+/- 2.70E-06	4.19E-05	+/- 1.93E-05
Average	1.02E-04	+/- 1.10E-04	9.70E-05	+/- 5.61E-04	2.33E-04	+/- 2.77E-05	2.57E-05	+/- 2.08E-05
N981 1	1.59E-04	+/- 9.51E-05	-5.72E-05	+/- 3.79E-04	6.72E-07	+/- 1.77E-06	-0.00001	+/- 1.75E-05
N981 2	1.85E-05	+/- 6.60E-05	-3.42E-04	+/- 5.88E-04	4.17E-07	+/- 1.98E-06	9.19E-06	+/- 2.06E-05
N981 3	6.43E-05	+/- 1.43E-04	6.70E-05	+/- 5.57E-04	2.82E-07	+/- 1.71E-06	3.91E-05	+/- 1.83E-05
N981 4	8.60E-06	+/- 5.74E-05	-2.50E-05	+/- 5.71E-04	-0.00000	+/- 1.55E-06	5.37E-05	+/- 2.31E-05
Average	6.26E-05	+/- 9.04E-05	-8.93E-05	+/- 5.24E-04	3.33E-07	+/- 1.75E-06	2.17E-05	+/- 1.99E-05
N982 1	-0.00001	+/- 6.28E-05	-7.00E-04	+/- 5.93E-04	1.16E-06	+/- 3.05E-06	3.18E-06	+/- 1.96E-05
N982 2	4.42E-05	+/- 7.02E-05	-1.44E-04	+/- 4.84E-04	-0.00000	+/- 1.62E-06	-0.00000	+/- 1.85E-05
N982 3	-0.00000	+/- 1.40E-04	3.02E-04	+/- 5.70E-04	2.42E-08	+/- 1.30E-06	3.48E-05	+/- 1.77E-05
N982 4	7.49E-07	+/- 6.39E-05	-1.72E-04	+/- 4.22E-04	1.99E-06	+/- 2.39E-06	3.34E-05	+/- 1.66E-05
Average	7.68E-06	+/- 8.42E-05	-1.79E-04	+/- 5.17E-04	6.53E-07	+/- 2.09E-06	1.63E-05	+/- 1.81E-05
N983 1	1.72E-04	+/- 1.01E-04	-1.50E-04	+/- 5.94E-04	6.76E-06	+/- 4.30E-06	1.41E-05	+/- 2.17E-05
N983 2	2.99E-05	+/- 6.97E-05	1.92E-05	+/- 5.57E-04	8.98E-07	+/- 1.72E-06	8.62E-06	+/- 2.04E-05
N983 3	-0.00000	+/- 1.12E-04	2.00E-04	+/- 4.36E-04	5.41E-07	+/- 1.59E-06	4.09E-05	+/- 1.89E-05
N983 4	1.95E-05	+/- 5.87E-05	2.15E-04	+/- 4.69E-04	1.69E-06	+/- 2.61E-06	3.35E-05	+/- 1.72E-05
Average	5.35E-05	+/- 8.54E-05	7.10E-05	+/- 5.14E-04	2.47E-06	+/- 2.56E-06	2.43E-05	+/- 1.96E-05
N984 1	5.68E-04	+/- 2.15E-04	3.50E-04	+/- 7.04E-04	5.11E-06	+/- 3.84E-06	2.74E-05	+/- 2.51E-05
N984 2	2.01E-05	+/- 7.41E-05	7.41E-04	+/- 4.53E-04	4.17E-05	+/- 1.05E-05	-0.00000	+/- 2.00E-05
N984 3	1.32E-04	+/- 1.38E-04	5.94E-04	+/- 5.55E-04	4.01E-06	+/- 4.34E-06	7.71E-05	+/- 3.03E-05
N984 4	3.23E-04	+/- 1.32E-04	6.71E-04	+/- 8.58E-04	8.58E-06	+/- 4.74E-06	7.05E-05	+/- 2.76E-05
Average	2.61E-04	+/- 1.40E-04	5.89E-04	+/- 6.43E-04	1.48E-05	+/- 5.85E-06	4.25E-05	+/- 2.58E-05
N985 1	1.76E-04	+/- 9.76E-05	-1.52E-04	+/- 5.22E-04	4.16E-04	+/- 5.56E-05	4.02E-05	+/- 2.79E-05
N985 2	6.22E-05	+/- 8.46E-05	-1.45E-04	+/- 6.39E-04	9.13E-07	+/- 1.73E-06	2.61E-05	+/- 2.41E-05
N985 3	-0.00002	+/- 8.00E-05	2.00E-04	+/- 6.86E-04	2.84E-06	+/- 3.08E-06	3.63E-05	+/- 1.87E-05
N985 4	2.63E-04	+/- 1.16E-04	5.94E-04	+/- 5.28E-04	1.49E-06	+/- 2.31E-06	7.65E-05	+/- 2.83E-05
Average	1.20E-04	+/- 9.46E-05	1.24E-04	+/- 5.94E-04	1.05E-04	+/- 1.57E-05	4.48E-05	+/- 2.48E-05

Table C-2. Air Sample Results for 200 East/West Area in pCi/m^3 (1990). (sheet 6 of 6)

Site Quarter	Sr-90	Error	Cs-137	Error	Pu-239	Error	U-Total	Error
N986 1	5.53E-04	+/- 1.93E-04	2.71E-04	+/- 4.43E-04	6.55E-06	+/- 5.06E-06	2.50E-05	+/- 2.44E-05
N986 2	1.08E-04	+/- 8.94E-05	3.35E-04	+/- 4.49E-04	5.60E-06	+/- 3.78E-06	-0.00000	+/- 1.97E-05
N986 3	6.46E-05	+/- 8.65E-05	1.98E-05	+/- 6.47E-04	5.20E-06	+/- 4.41E-06	5.27E-05	+/- 2.28E-05
N986 4	1.46E-04	+/- 8.77E-05	1.00E-06	+/- 5.31E-04	9.87E-07	+/- 2.54E-06	8.14E-05	+/- 3.02E-05
Average	2.18E-04	+/- 1.14E-04	1.57E-04	+/- 5.18E-04	4.58E-06	+/- 3.95E-06	3.77E-05	+/- 2.43E-05
N987 1	2.36E-04	+/- 1.24E-04	-4.57E-04	+/- 6.76E-04	2.20E-06	+/- 3.37E-06	2.02E-05	+/- 2.75E-05
N987 2	6.44E-05	+/- 8.80E-05	1.41E-04	+/- 6.78E-04	1.43E-06	+/- 2.02E-06	-0.00001	+/- 1.86E-05
N987 3	1.48E-05	+/- 8.08E-05	4.30E-04	+/- 4.95E-04	9.51E-07	+/- 3.04E-06	4.59E-05	+/- 2.07E-05
N987 4	9.28E-05	+/- 7.56E-05	5.72E-05	+/- 5.48E-04	3.84E-06	+/- 2.79E-06	3.82E-05	+/- 1.79E-05
Average	1.02E-04	+/- 9.21E-05	4.28E-05	+/- 5.99E-04	2.11E-06	+/- 2.81E-06	2.24E-05	+/- 2.12E-05
N991 1	1.12E-04	+/- 9.32E-05	2.33E-04	+/- 5.95E-04	3.94E-05	+/- 1.03E-05	8.70E-07	+/- 1.98E-05
N991 2	4.94E-05	+/- 7.50E-05	0.00000	+/- 5.84E-04	1.89E-06	+/- 2.23E-06	1.46E-05	+/- 2.28E-05
N991 3	1.94E-05	+/- 9.59E-05	-1.93E-04	+/- 4.70E-04	6.86E-07	+/- 1.50E-06	5.57E-05	+/- 2.25E-05
N991 4	1.26E-04	+/- 8.37E-05	3.97E-04	+/- 5.51E-04	9.27E-07	+/- 1.42E-06	2.54E-05	+/- 1.38E-05
Average	7.67E-05	+/- 8.69E-05	1.09E-04	+/- 5.50E-04	1.07E-05	+/- 3.86E-06	2.41E-05	+/- 1.97E-05
N992 1	6.02E-04	+/- 2.07E-04	4.00E-04	+/- 5.00E-04	3.77E-07	+/- 1.36E-06	2.12E-05	+/- 2.30E-05
N992 2	3.94E-05	+/- 8.18E-05	-5.07E-05	+/- 4.64E-04	-0.00000	+/- 1.25E-06	-0.00000	+/- 1.90E-05
N992 3	-0.00003	+/- 6.14E-05	4.09E-04	+/- 4.70E-04	8.20E-07	+/- 1.77E-06	3.39E-05	+/- 1.66E-05
N992 4	3.94E-07	+/- 6.08E-05	-6.66E-05	+/- 4.73E-04	-0.00000	+/- 2.26E-06	2.96E-05	+/- 1.54E-05
Average	1.52E-04	+/- 1.03E-04	1.73E-04	+/- 4.77E-04	-0.00000	+/- 1.66E-06	2.09E-05	+/- 1.85E-05
N993 1	3.71E-04	+/- 1.45E-04	2.70E-04	+/- 6.07E-04	2.09E-06	+/- 2.20E-06	3.45E-05	+/- 2.65E-05
N993 2	1.84E-05	+/- 7.23E-05	-2.96E-04	+/- 5.75E-04	1.98E-06	+/- 2.49E-06	7.65E-06	+/- 2.05E-05
N993 3	2.98E-05	+/- 9.01E-05	7.53E-04	+/- 5.89E-04	4.19E-06	+/- 3.25E-06	9.30E-05	+/- 3.31E-05
N993 4	1.14E-04	+/- 8.17E-05	3.77E-04	+/- 4.42E-04	1.29E-06	+/- 2.38E-06	3.71E-05	+/- 1.73E-05
Average	1.33E-04	+/- 9.73E-05	2.76E-04	+/- 5.53E-04	2.39E-06	+/- 2.58E-06	4.31E-05	+/- 2.43E-05
N994 1	3.00E-04	+/- 1.29E-04	-5.07E-04	+/- 5.93E-04	1.12E-06	+/- 1.97E-06	-0.00000	+/- 1.85E-05
N994 2	-0.00002	+/- 8.19E-05	-2.72E-04	+/- 4.92E-04	6.51E-07	+/- 1.81E-06	-0.00000	+/- 1.94E-05
N994 3	-0.00002	+/- 8.18E-05	-9.29E-05	+/- 4.95E-04	1.30E-06	+/- 1.94E-06	5.36E-05	+/- 2.19E-05
N994 4	6.46E-05	+/- 9.41E-05	-3.78E-05	+/- 6.06E-04	1.01E-06	+/- 2.60E-06	2.82E-05	+/- 1.44E-05
Average	7.95E-05	+/- 9.67E-05	-2.27E-04	+/- 5.47E-04	1.02E-06	+/- 2.08E-06	1.70E-05	+/- 1.86E-05
N996 1	1.49E-04	+/- 1.15E-04	9.15E-06	+/- 5.58E-04	-0.00000	+/- 2.23E-06	2.71E-05	+/- 2.73E-05
N996 2	4.76E-05	+/- 9.69E-05	1.80E-04	+/- 5.99E-04	1.56E-06	+/- 2.26E-06	3.06E-05	+/- 2.87E-05
N996 3	2.81E-04	+/- 2.09E-04	-4.45E-04	+/- 9.45E-04	2.65E-06	+/- 5.49E-06	7.99E-05	+/- 3.62E-05
N996 4		+/-		+/-		+/-		+/-
Average	1.59E-04	+/- 1.40E-04	-8.53E-05	+/- 7.01E-04	1.20E-06	+/- 3.33E-06	4.59E-05	+/- 3.07E-05
N997 1	1.41E-04	+/- 1.27E-04	-3.69E-05	+/- 6.68E-04	5.52E-06	+/- 3.99E-06	-0.00001	+/- 2.20E-05
N997 2	-0.00008	+/- 1.60E-04	5.28E-04	+/- 1.04E-03	-0.00000	+/- 3.71E-06	-0.00001	+/- 6.01E-05
N997 3	6.13E-05	+/- 5.44E-04	2.53E-03	+/- 3.27E-03	-0.00000	+/- 1.47E-05	1.61E-04	+/- 8.87E-05
N997 4		+/-		+/-		+/-		+/-
Average	3.79E-05	+/- 2.77E-04	1.01E-03	+/- 1.66E-03	5.51E-07	+/- 7.47E-06	4.46E-05	+/- 5.69E-05

Figure C-4. The Strontium-90 in Air, 200 East Area.

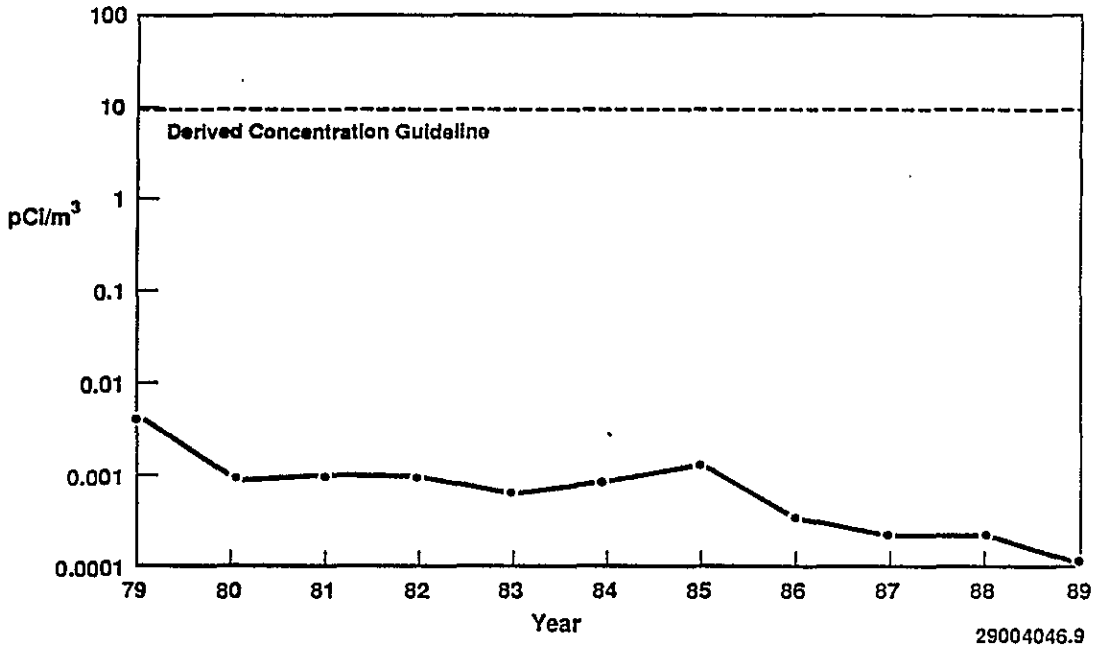


Figure C-5. The Strontium-90 in Air, 200 West Area.

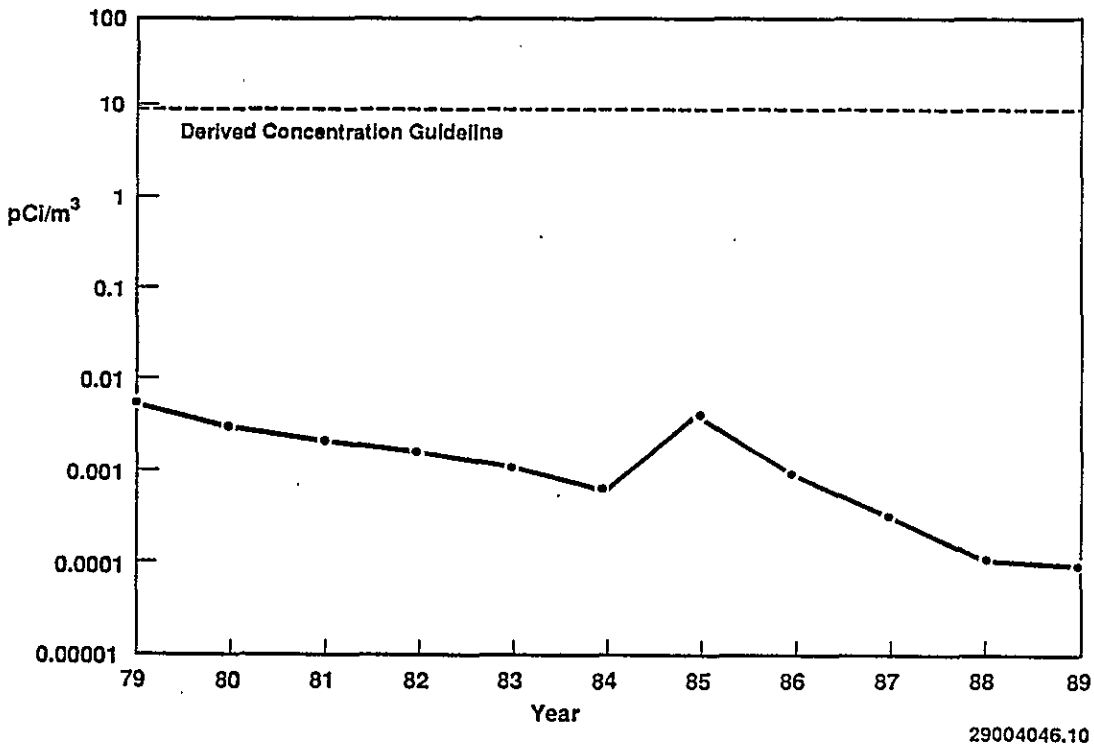


Figure C-6. The Cesium-137 in Air, 200 East Area.

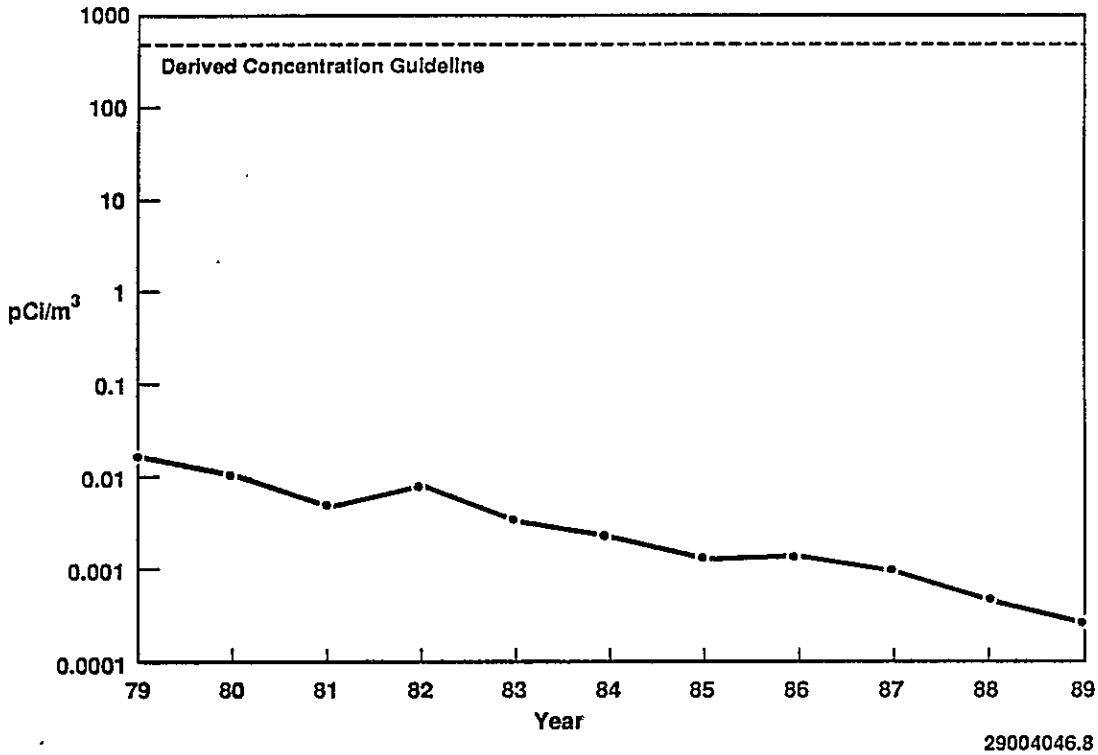


Figure C-7. The Cesium-137 in Air, 200 West Area.

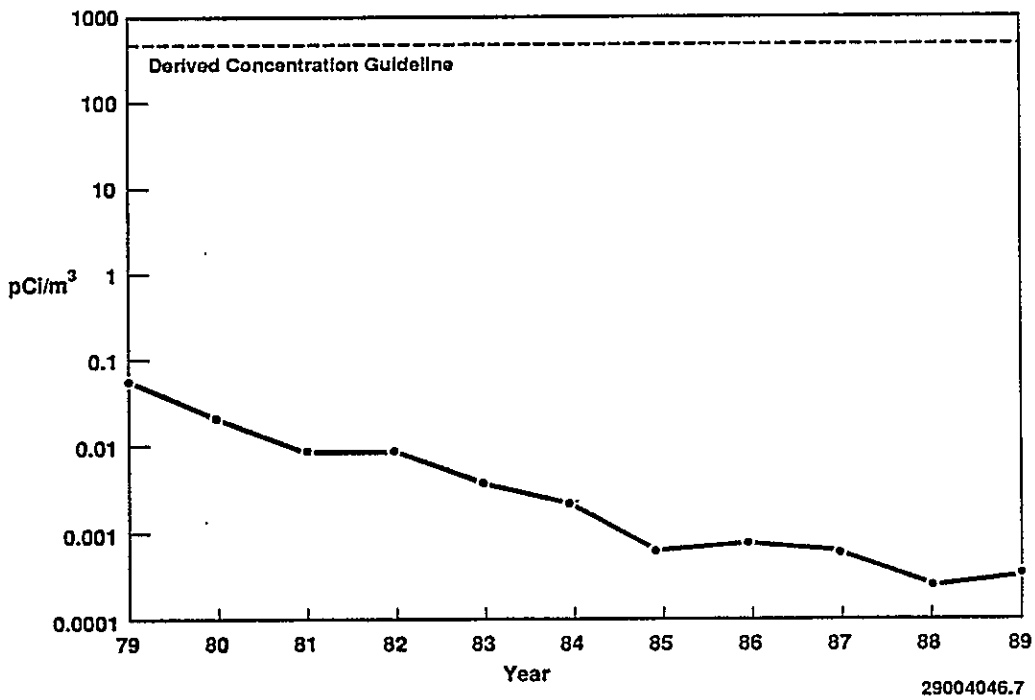


Figure C-8. The Plutonium-239 in Air, 200 East Area.

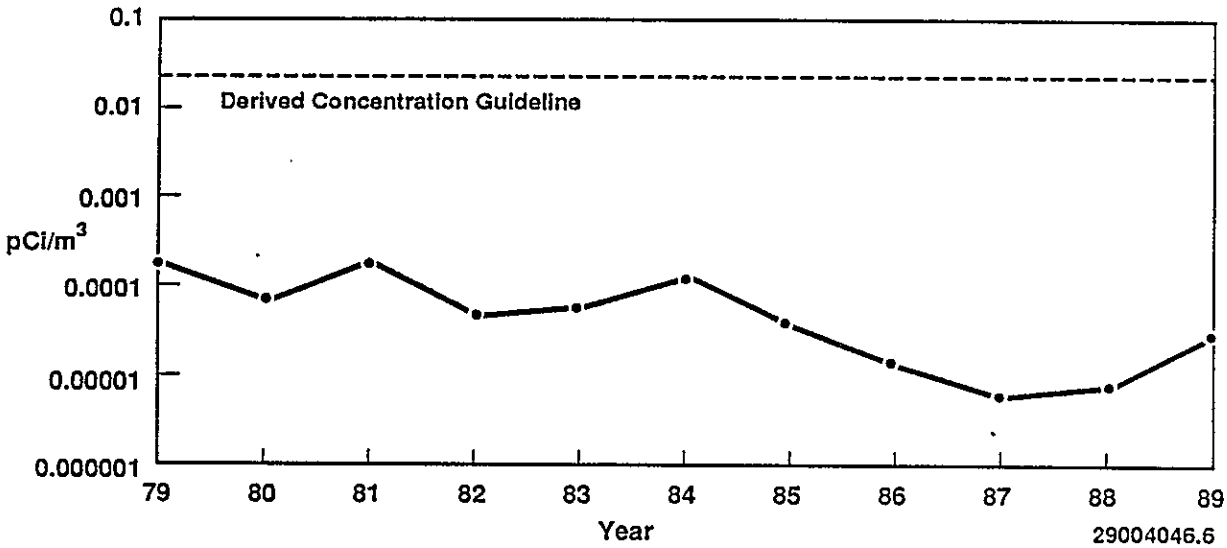
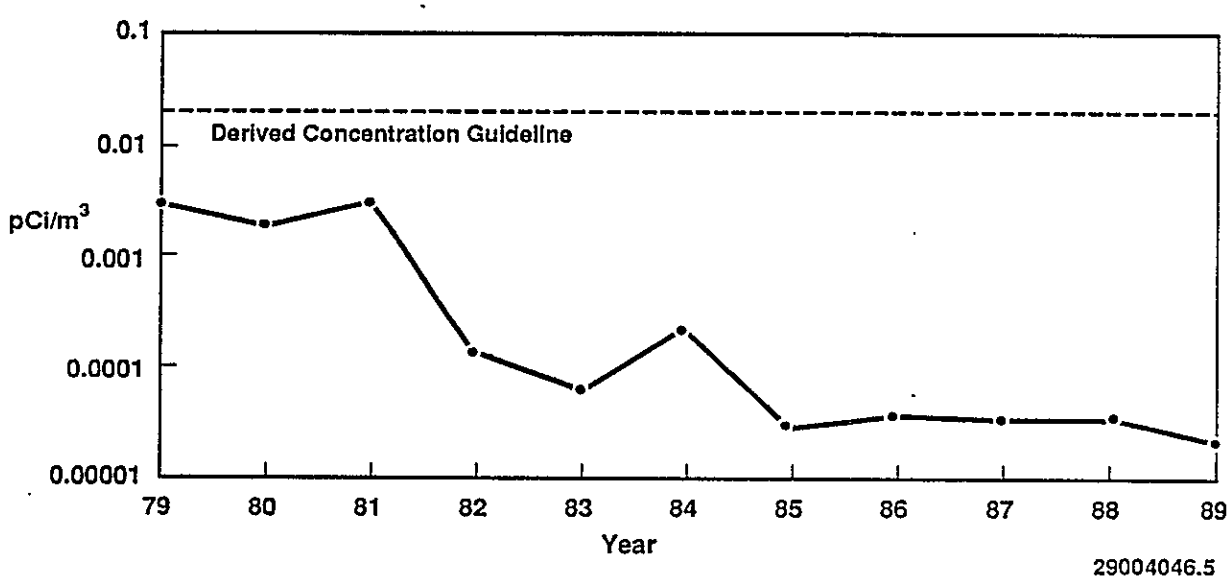


Figure C-9. The Plutonium-239 in Air, 200 West Area.



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APPENDIX D

GROUNDWATER MONITORING FIGURES AND TABLES

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Figure D-1. Groundwater Monitoring Wells in the 200 East Area.

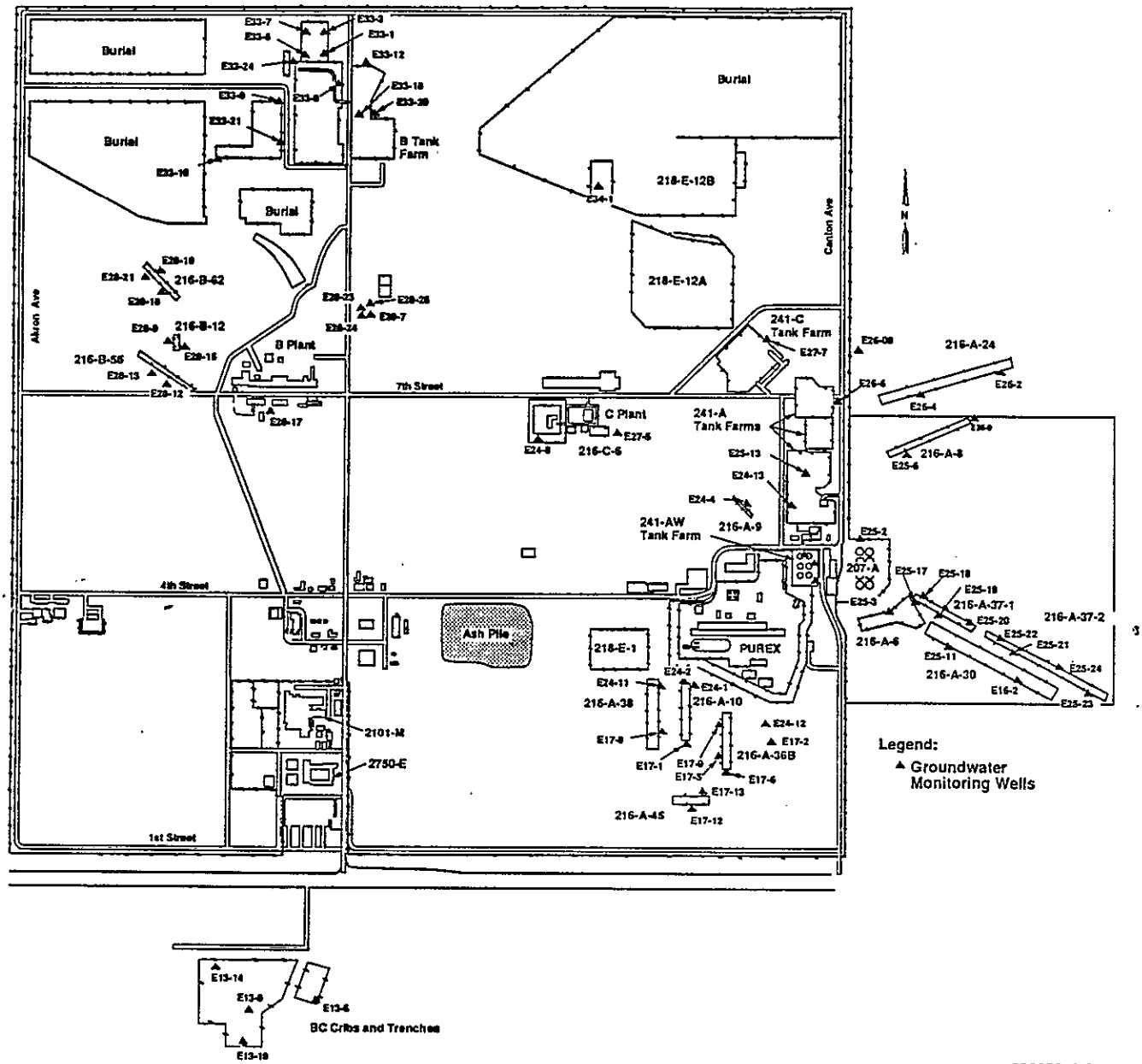
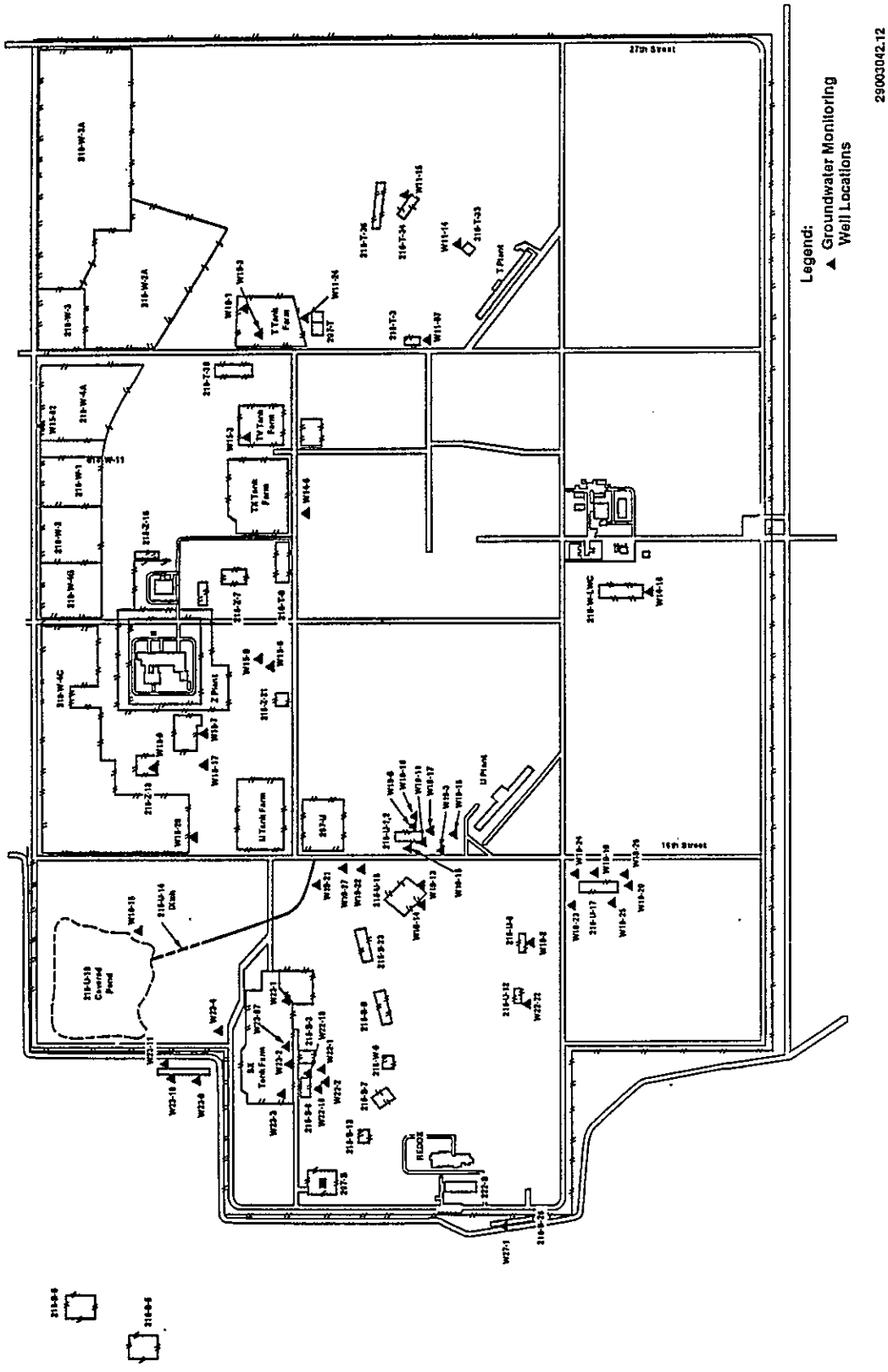


Figure D-2. Groundwater Monitoring Wells in the 200 West Area.



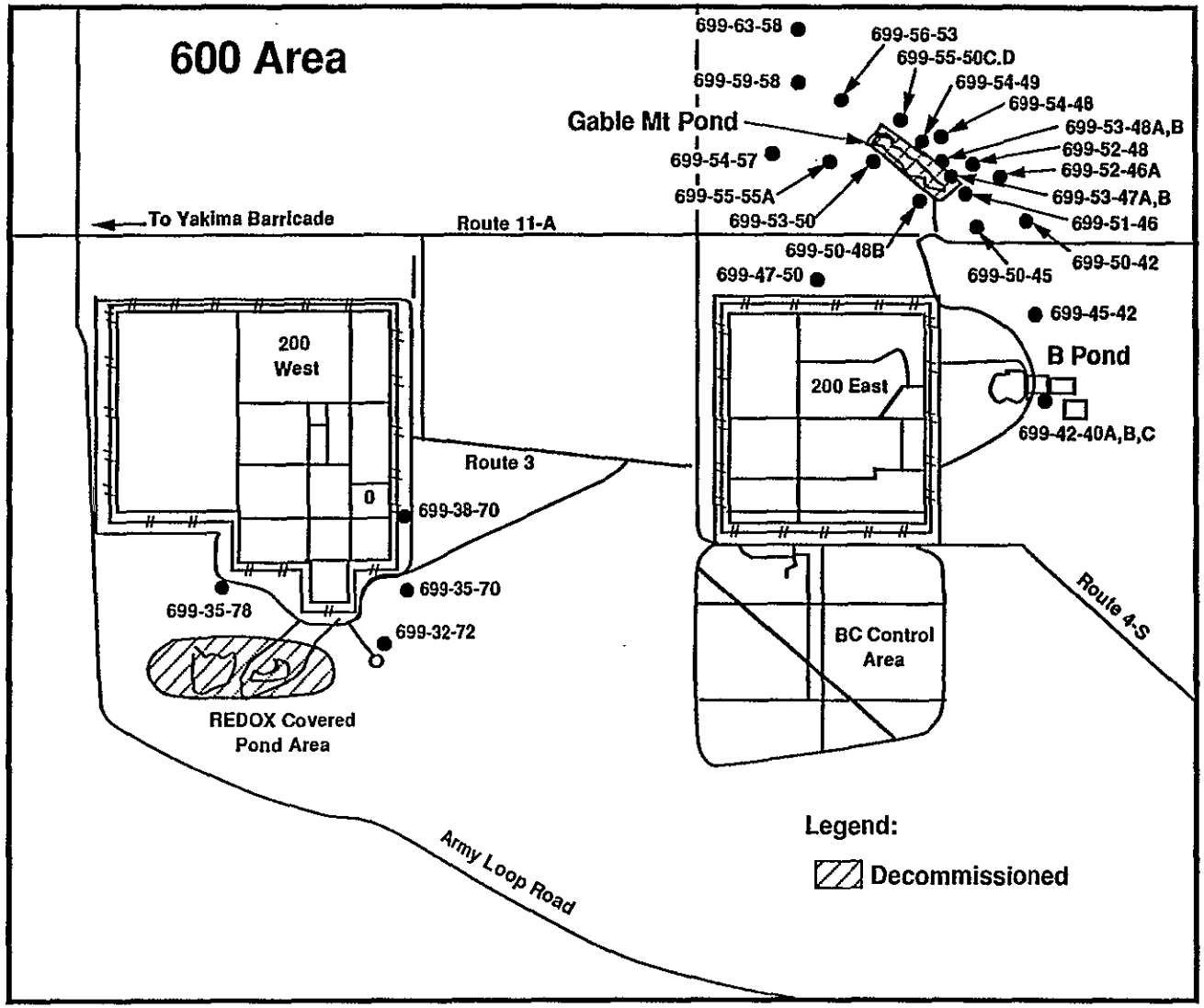


Figure D-3. Location of the 600 Area Monitoring Wells Used in the Separations Area Groundwater Monitoring Program.

Figure D-4. Total Uranium in Groundwater at the 216-B-62 Crib.

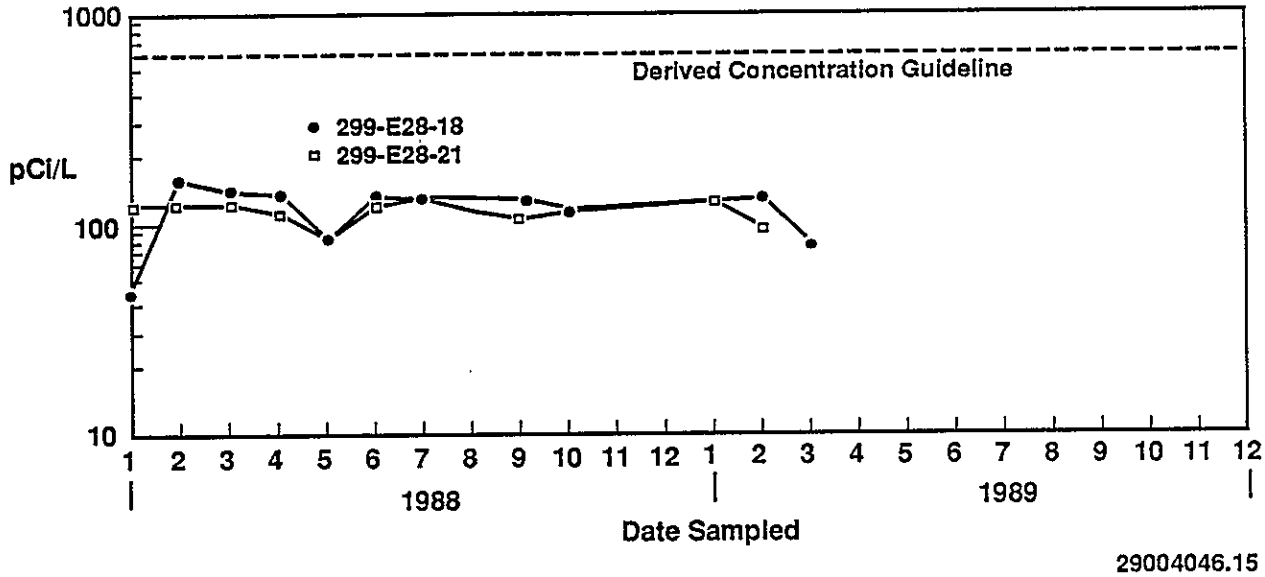


Figure D-5. Total Uranium in Groundwater at the 216-S-25 Crib.

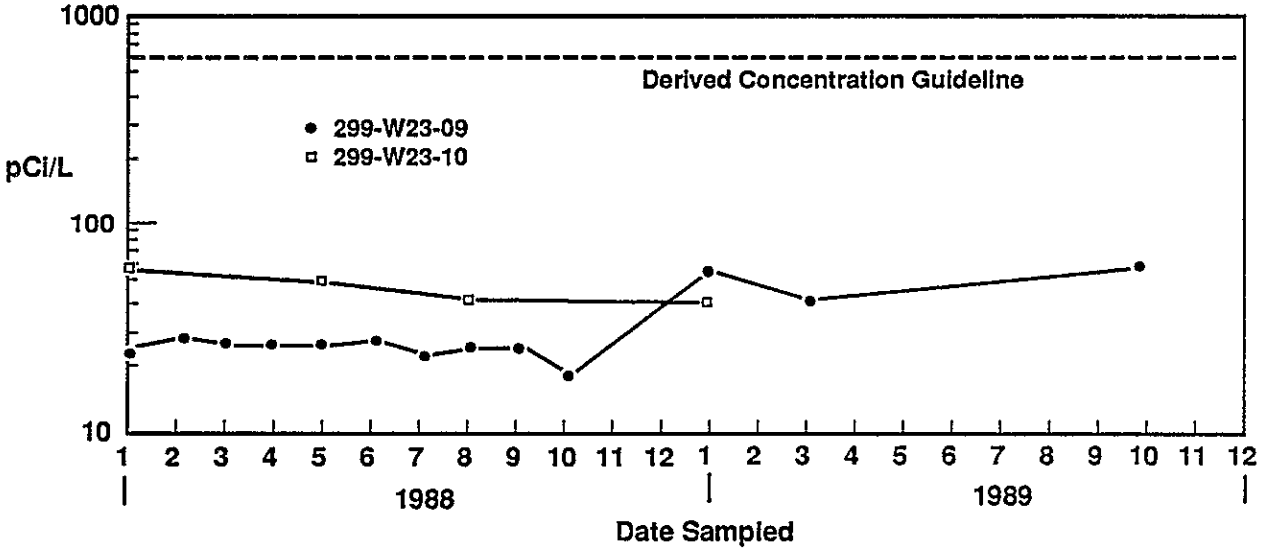


Figure D-6. Total Uranium in Groundwater Upgradient of the 216-U-1 and 216-U-2 Cribs.

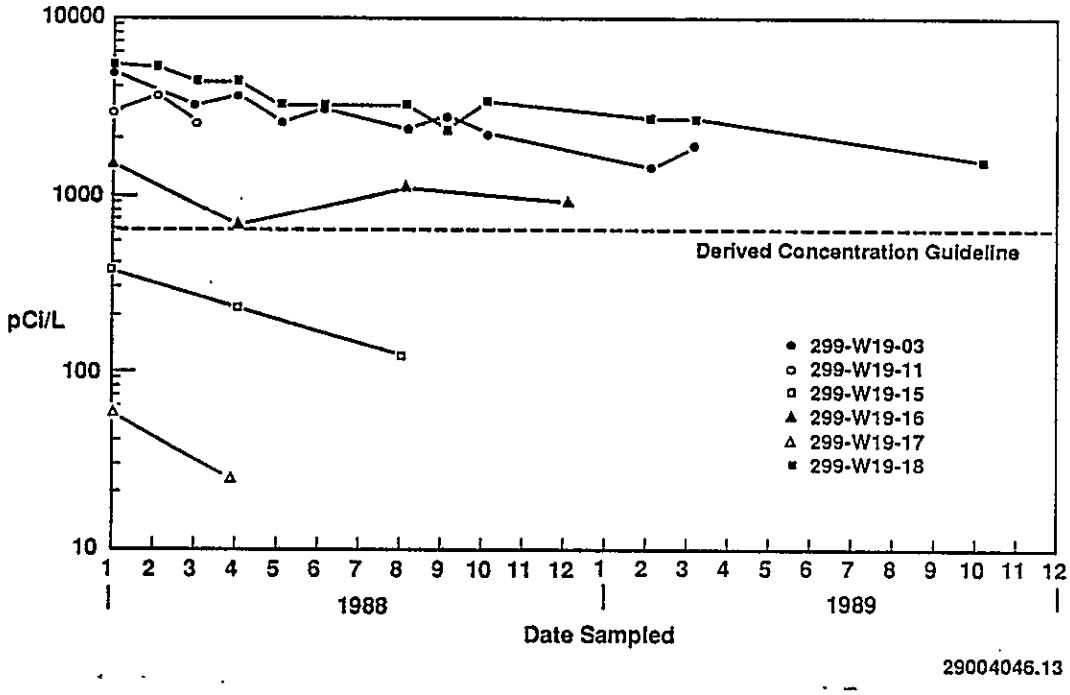


Figure D-7. Total Uranium in Groundwater Downgradient of the 216-U-1 and 216-U-2 Cribs.

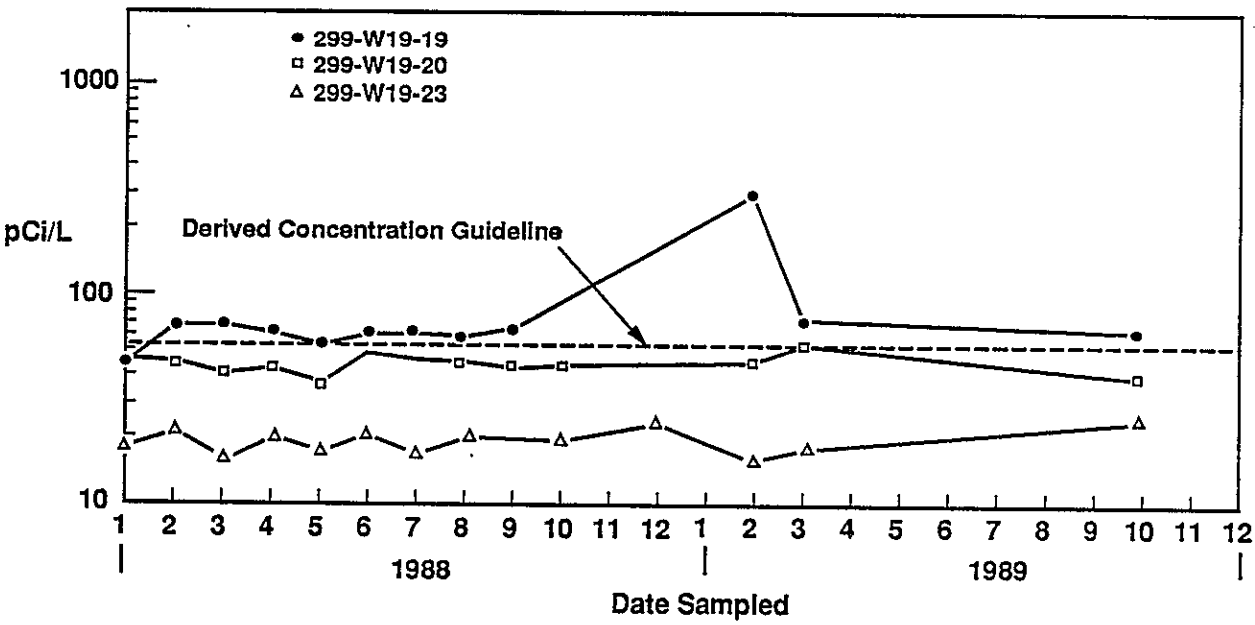


Figure D-8. Total Uranium in Groundwater at the 216-U-17 Crib.

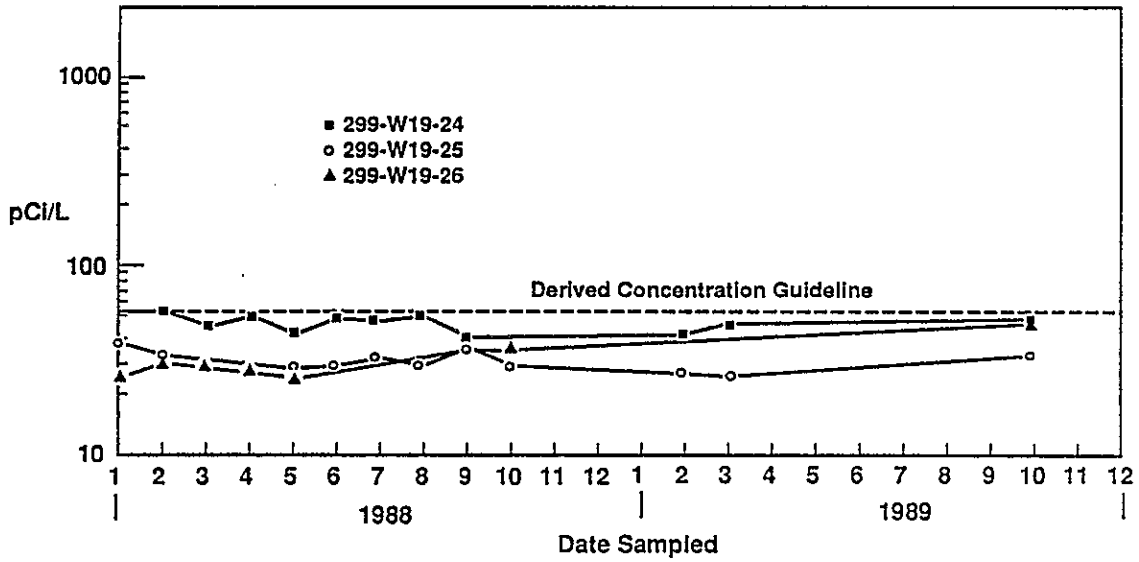
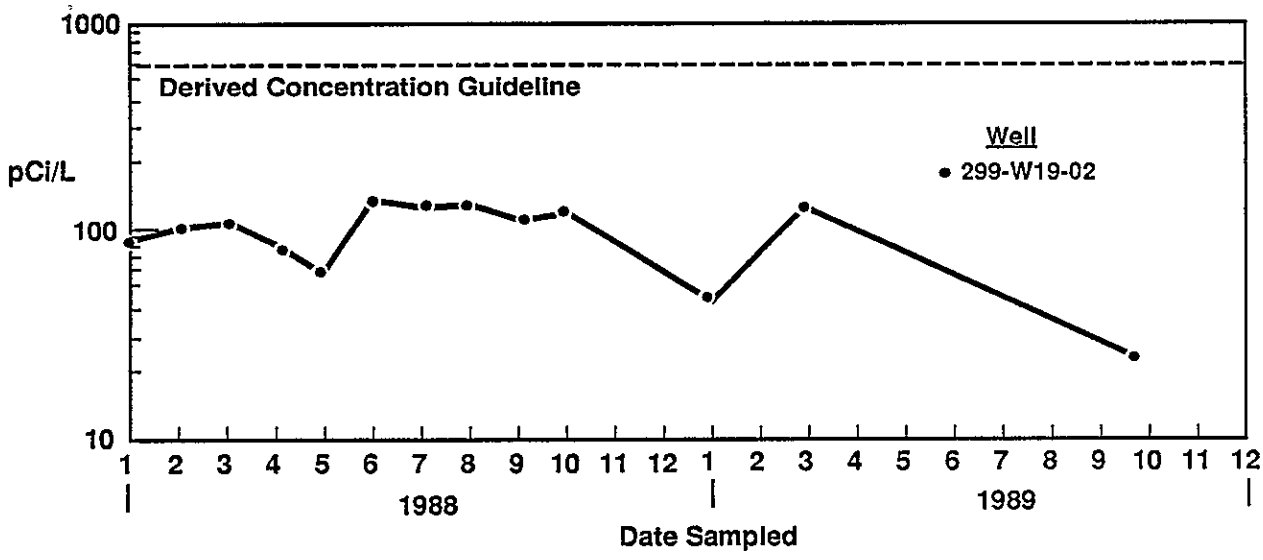


Figure D-9. Total Uranium in Groundwater at the 216-U-08 Crib.



APPENDIX E

SOIL AND BIOTA MONITORING FIGURES AND TABLES

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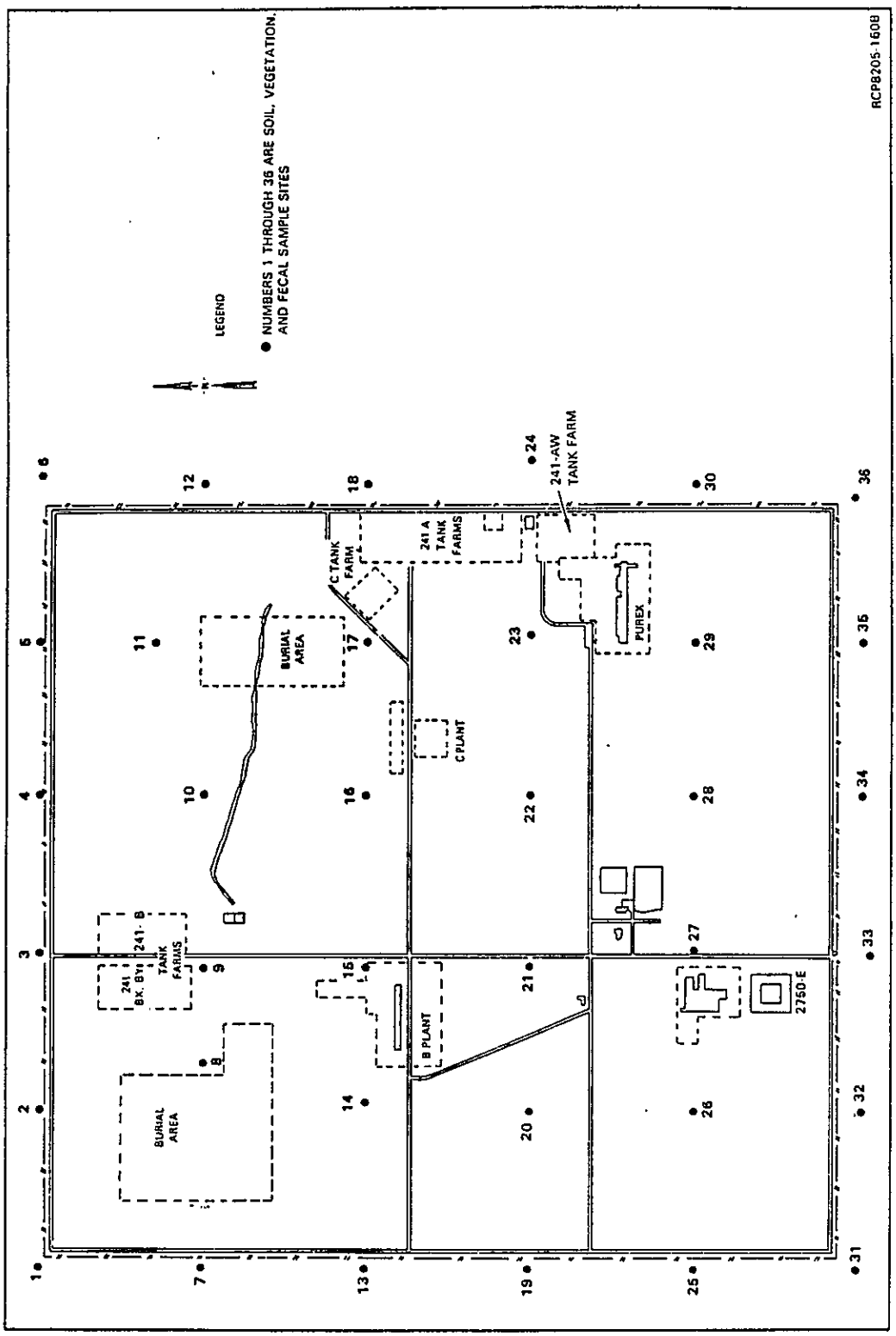
Figure E-1. The 200 East Area Grid Sampling Sites.



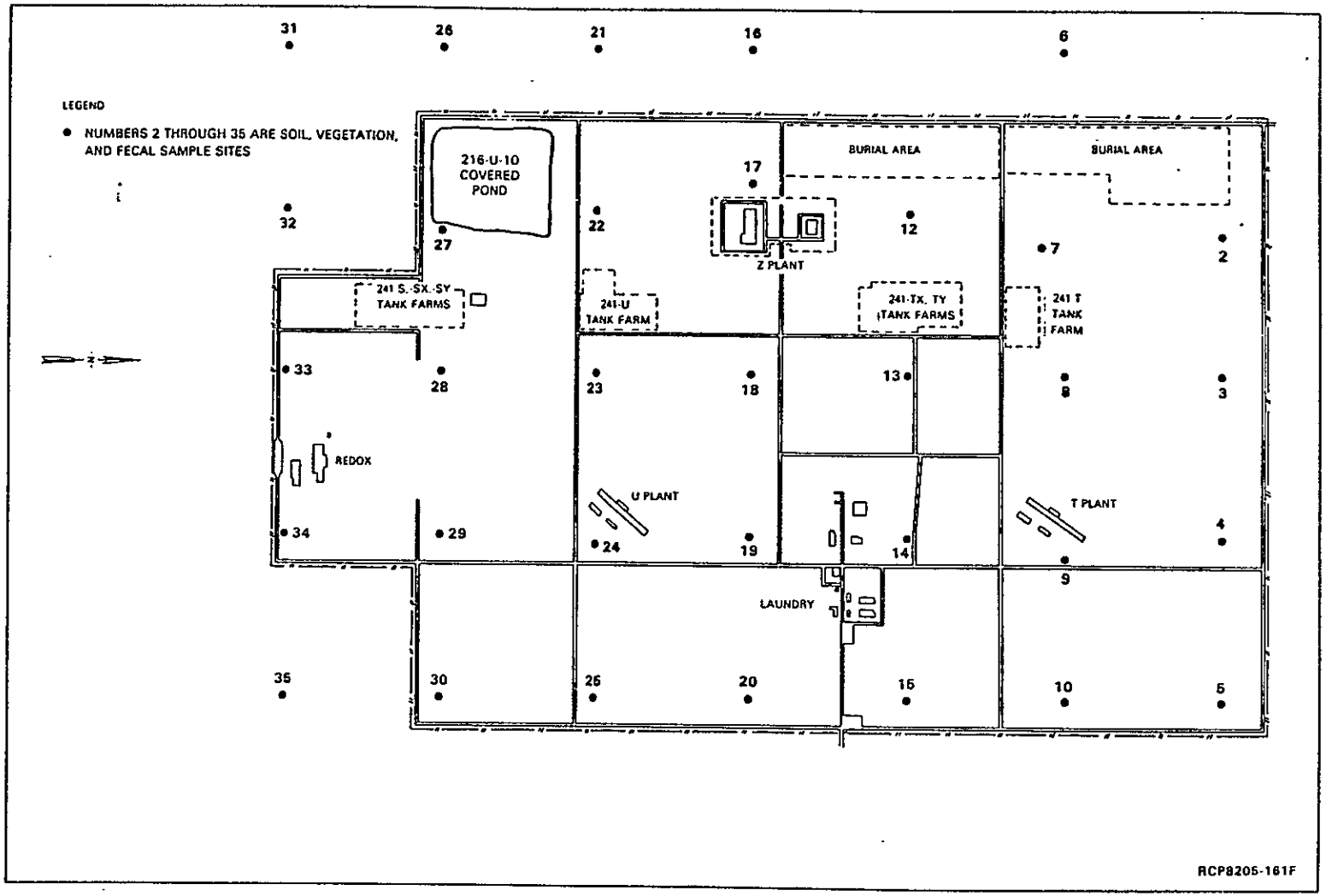


Figure E-2. The 200 West Area Grid Sampling Sites.

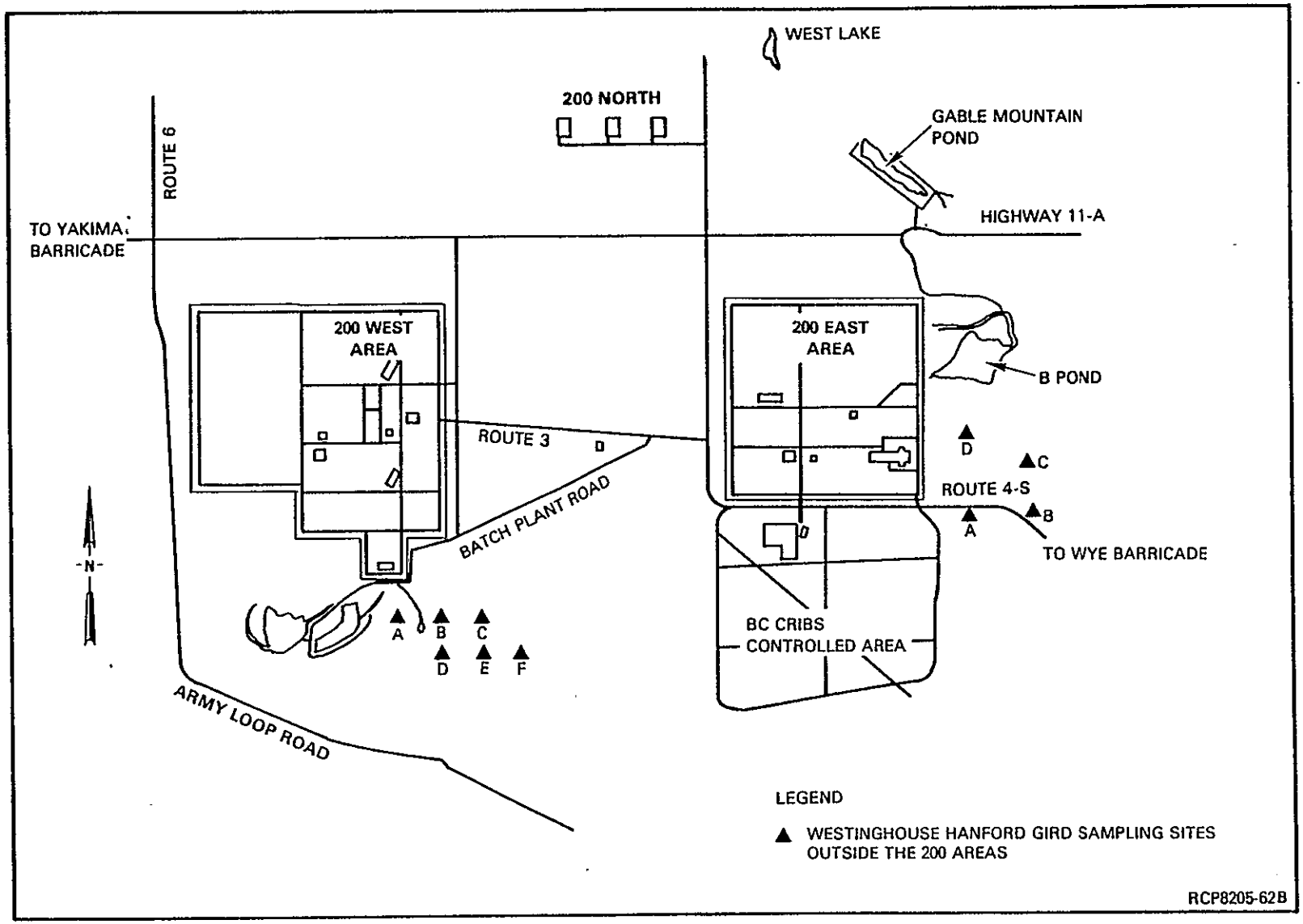


Figure E-3. Grid Sampling Outside the 200 Area Perimeter Fences.

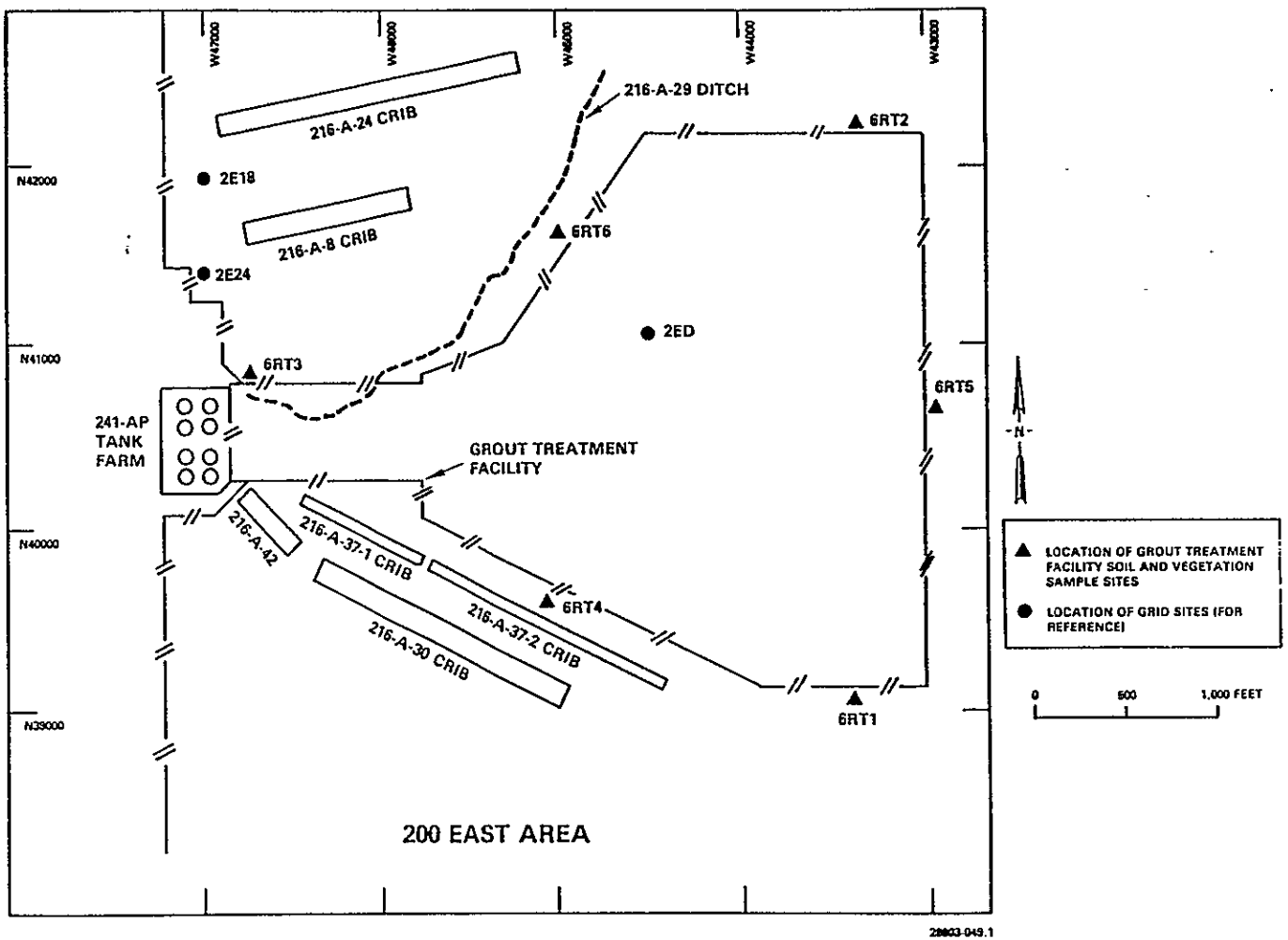


Figure E-4. Location of Grout Treatment Facility Sample Sites.

Figure E-5. Fenceline Soil Sampling Plots in the 200 East Area.

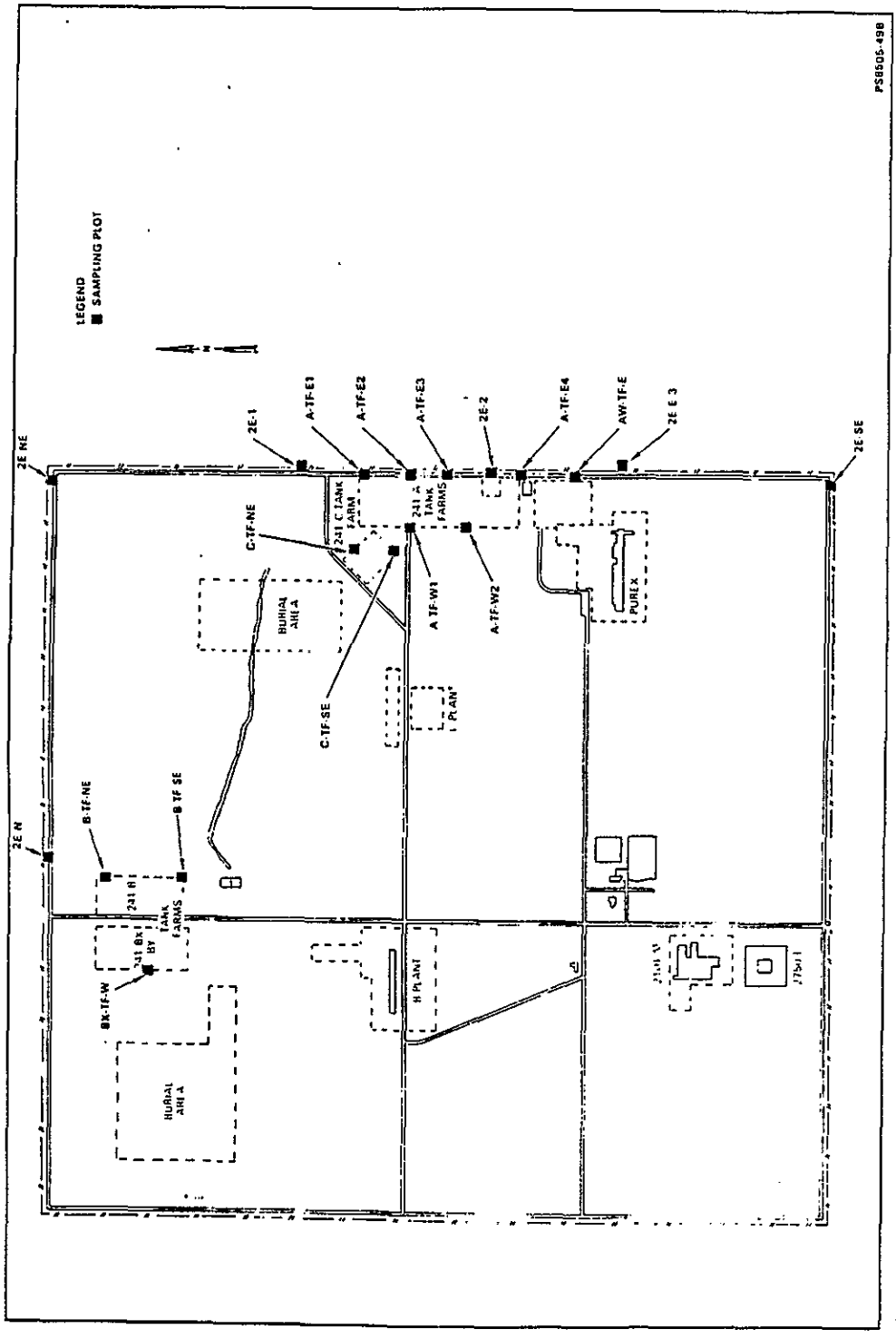


Figure E-6. Fenceline Soil Sampling Plots in the 200 West Area.

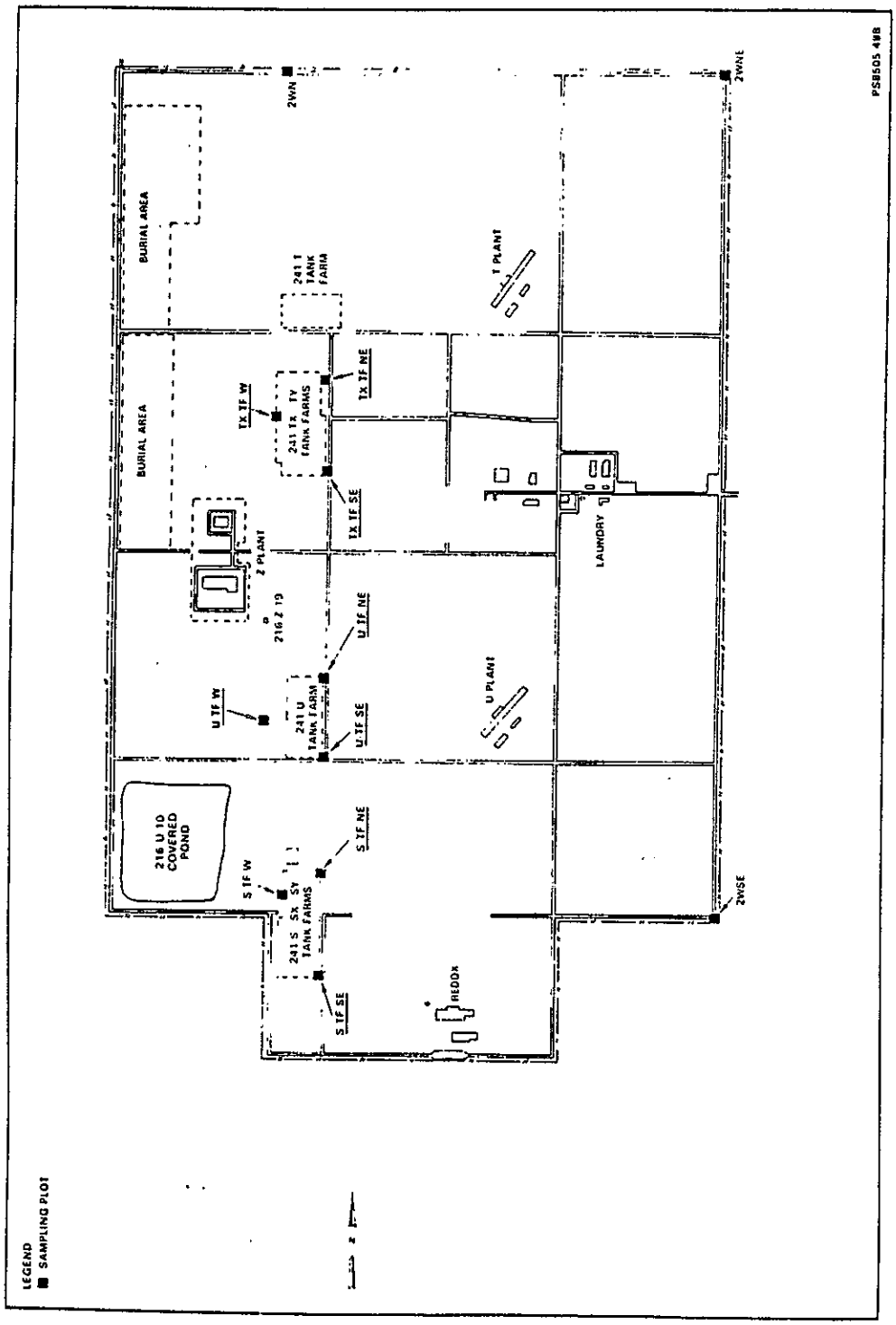


Table E-1. Grid Site Soil Results for 200 West Area for 1989 (pCi/g dry weight). (sheet 1 of 6)

Location	Nuclide	Result	+/- Error
2W7	Ce-141	-0.0563	7.44E-02
2W7	Ce-144	-0.0248	1.02E-01
2W7	Co-58	-0.00682	2.55E-02
2W7	Co-60	9.28E-03	1.94E-02
2W7	Cs-134	-0.0496	1.86E-02
2W7	Cs-137	1.27E+00	1.39E-01
2W7	Eu-152	1.18E-01	7.59E-02
2W7	Eu-154	-0.0616	6.03E-02
2W7	Eu-155	1.92E-02	5.68E-02
2W7	I-129	-0.0158	3.11E-01
2W7	K-40	1.59E+01	1.76E+00
2W7	Mn-54	-0.00174	1.85E-02
2W7	Nb-95	-0.0845	5.93E-02
2W7	Pb-212	7.10E-01	8.29E-02
2W7	Pb-214	5.32E-01	7.66E-02
2W7	Pu-238	4.50E-04	2.00E-04
2W7	Pu-239	1.13E-02	1.45E-03
2W7	Ru-106	7.92E-02	1.58E-01
2W7	Sr-90	1.64E-01	3.42E-02
2W7	Tc-99	1.27E-01	1.16E+00
2W7	U	3.77E-01	1.14E-01
2W7	Zn-65	-0.104	5.62E-02
2W7	Zr-95	-0.00883	4.83E-02
2W8	Ce-141	8.30E-02	1.94E-01
2W8	Ce-144	-0.266	2.69E-01
2W8	Co-58	1.19E-03	2.39E-02
2W8	Co-60	1.29E-02	1.94E-02
2W8	Cs-134	-0.0812	4.09E-02
2W8	Cs-137	4.26E+01	4.27E+00
2W8	Eu-152	1.23E-01	7.44E-02
2W8	Eu-154	4.63E-02	5.31E-02
2W8	Eu-155	-0.114	1.48E-01
2W8	I-129	-1.48	9.03E-01
2W8	K-40	1.40E+01	1.57E+00
2W8	Mn-54	2.77E-02	1.81E-02
2W8	Nb-95	6.88E-03	6.30E-02
2W8	Pb-212	6.75E-01	1.06E-01
2W8	Pb-214	6.38E-01	1.43E-01
2W8	Pu-238	2.47E-03	5.67E-04
2W8	Pu-239	1.15E-01	1.20E-02
2W8	Ru-106	3.02E-02	4.12E-01
2W8	Sr-90	7.72E-01	1.63E-01
2W8	Tc-99	1.33E-01	1.16E+00
2W8	U	5.50E-01	1.60E-01
2W8	Zn-65	-0.14	6.07E-02
2W8	Zr-95	-0.00818	5.73E-02

Note: Negative values indicate concentrations at or near background levels of radioactivity.

Table E-1. Grid Site Soil Results for 200 West Area for 1989 (pCi/g dry weight). (sheet 2 of 6)

Location	Nuclide	Result	+/- Error
2W9	Ce-141	4.35E-02	8.51E-02
2W9	Ce-144	2.11E-02	1.08E-01
2W9	Co-58	-0.00407	2.88E-02
2W9	Co-60	-0.00174	1.77E-02
2W9	Cs-134	-0.0253	1.81E-02
2W9	Cs-137	3.72E+00	3.85E-01
2W9	Eu-152	4.16E-02	6.08E-02
2W9	Eu-154	3.42E-02	5.10E-02
2W9	Eu-155	3.85E-02	5.60E-02
2W9	I-129	-0.493	5.08E-01
2W9	K-40	1.16E+01	1.37E+00
2W9	Mn-54	1.53E-02	1.70E-02
2W9	Nb-95	-0.0304	6.52E-02
2W9	Pb-212	4.99E-01	6.40E-02
2W9	Pb-214	5.31E-01	8.02E-02
2W9	Pu-238	6.57E-03	1.04E-03
2W9	Pu-239	1.22E+00	1.21E-01
2W9	Ru-106	8.84E-02	1.55E-01
2W9	Sr-90	1.52E+00	3.19E-01
2W9	Tc-99	-0.0994	1.15E+00
2W9	U	2.06E-01	6.75E-02
2W9	Zn-65	-0.0747	5.23E-02
2W9	Zr-95	3.58E-02	5.81E-02
2W13	Ce-141	-0.0594	1.59E-01
2W13	Ce-144	-0.138	2.25E-01
2W13	Co-58	1.97E-03	3.38E-02
2W13	Co-60	-0.00148	2.05E-02
2W13	Cs-134	-0.0417	3.26E-02
2W13	Cs-137	1.57E+01	1.58E+00
2W13	Eu-152	6.88E-02	9.71E-02
2W13	Eu-154	7.03E-02	6.28E-02
2W13	Eu-155	7.43E-02	1.23E-01
2W13	I-129	-1.16	7.49E-01
2W13	K-40	1.42E+01	1.65E+00
2W13	Mn-54	-0.00207	2.11E-02
2W13	Nb-95	-0.0109	7.32E-02
2W13	Pb-212	7.10E-01	9.77E-02
2W13	Pb-214	6.04E-01	1.12E-01
2W13	Pu-238	1.63E-03	4.63E-04
2W13	Pu-239	1.64E-01	1.71E-02
2W13	Ru-106	2.47E-01	3.42E-01
2W13	Sr-90	8.63E-01	1.84E-01
2W13	Tc-99	-0.114	1.15E+00
2W13	U	3.24E-01	1.00E-01
2W13	Zn-65	-0.222	7.51E-02
2W13	Zr-95	2.61E-02	6.50E-02

Table E-1. Grid Site Soil Results for 200 West Area for 1989 (pCi/g dry weight). (sheet 3 of 6)

Location	Nuclide	Result	+/- Error
2W14	Ce-141	-0.0169	9.17E-02
2W14	Ce-144	3.06E-02	1.08E-01
2W14	Co-58	6.38E-04	3.06E-02
2W14	Co-60	1.83E-02	1.81E-02
2W14	Cs-134	-0.00639	1.71E-02
2W14	Cs-137	2.73E+00	2.86E-01
2W14	Eu-152	3.43E-02	8.46E-02
2W14	Eu-154	-0.00139	5.53E-02
2W14	Eu-155	3.53E-02	5.21E-02
2W14	I-129	-0.229	3.24E-01
2W14	K-40	1.33E+01	1.54E+00
2W14	Mn-54	1.14E-02	2.10E-02
2W14	Nb-95	3.02E-02	7.47E-02
2W14	Pb-212	7.36E-01	8.66E-02
2W14	Pb-214	7.34E-01	9.96E-02
2W14	Pu-238	5.66E-03	9.88E-04
2W14	Pu-239	4.76E-01	4.87E-02
2W14	Ru-106	4.83E-02	1.71E-01
2W14	Sr-90	2.65E-01	5.14E-02
2W14	Tc-99	-0.115	1.15E+00
2W14	U	2.60E-01	8.45E-02
2W14	Zn-65	-0.067	5.35E-02
2W14	Zr-95	8.75E-02	6.03E-02
2W17	Ce-141	2.61E-02	7.53E-02
2W17	Ce-144	8.69E-02	9.44E-02
2W17	Co-58	-0.0157	2.81E-02
2W17	Co-60	-0.00889	1.58E-02
2W17	Cs-134	4.00E-03	1.52E-02
2W17	Cs-137	4.78E-01	6.20E-02
2W17	Eu-152	4.65E-02	7.45E-02
2W17	Eu-154	-0.00628	5.08E-02
2W17	Eu-155	5.38E-02	4.99E-02
2W17	I-129	2.52E-01	5.00E-01
2W17	K-40	1.36E+01	1.54E+00
2W17	Mn-54	-0.00178	1.85E-02
2W17	Nb-95	-0.102	6.44E-02
2W17	Pb-212	8.09E-01	9.32E-02
2W17	Pb-214	6.59E-01	8.69E-02
2W17	Pu-238	2.98E-03	6.45E-04
2W17	Pu-239	1.34E-01	1.40E-02
2W17	Ru-106	1.91E-02	1.59E-01
2W17	Sr-90	1.27E-01	2.73E-02
2W17	Tc-99	-0.0771	1.15E+00
2W17	U	4.46E-01	1.35E-01
2W17	Zn-65	-0.00187	4.56E-02
2W17	Zr-95	-0.00316	6.04E-02

Table E-1. Grid Site Soil Results for 200 West Area for 1989 (pCi/g dry weight). (sheet 4 of 6)

Location	Nuclide	Result	+/- Error
2W23	Ce-141	-0.00392	2.09E-01
2W23	Ce-144	8.80E-02	2.66E-01
2W23	Co-58	1.59E-03	2.49E-02
2W23	Co-60	2.42E-02	1.92E-02
2W23	Cs-134	-0.106	4.03E-02
2W23	Cs-137	5.80E+01	5.81E+00
2W23	Eu-152	2.75E-02	7.94E-02
2W23	Eu-154	6.66E-02	5.25E-02
2W23	Eu-155	-0.0141	1.27E-01
2W23	I-129	1.81E-01	6.06E-01
2W23	K-40	1.44E+01	1.59E+00
2W23	Mn-54	1.15E-02	1.87E-02
2W23	Nb-95	-0.0668	6.75E-02
2W23	Pb-212	6.38E-01	1.07E-01
2W23	Pb-214	5.42E-01	1.19E-01
2W23	Pu-238	2.87E-02	3.33E-03
2W23	Pu-239	1.53E+00	1.53E-01
2W23	Ru-106	-0.0718	4.02E-01
2W23	Sr-90	1.54E+00	3.22E-01
2W23	Tc-99	2.35E-01	1.17E+00
2W23	U	5.57E-01	1.63E-01
2W23	Zn-65	-0.0863	5.25E-02
2W23	Zr-95	2.78E-02	5.58E-02
2W24	Ce-141	-0.0739	7.83E-02
2W24	Ce-144	-0.0166	9.22E-02
2W24	Co-58	-0.00596	2.52E-02
2W24	Co-60	2.89E-03	1.50E-02
2W24	Cs-134	-0.0603	1.80E-02
2W24	Cs-137	1.03E+00	1.13E-01
2W24	Eu-152	1.74E-02	7.65E-02
2W24	Eu-154	1.16E-02	4.53E-02
2W24	Eu-155	-0.00275	4.79E-02
2W24	I-129	2.76E-01	2.85E-01
2W24	K-40	1.36E+01	1.51E+00
2W24	Mn-54	1.08E-02	1.59E-02
2W24	Nb-95	-0.0624	5.77E-02
2W24	Pb-212	6.98E-01	7.95E-02
2W24	Pb-214	6.09E-01	7.90E-02
2W24	Pu-238	6.61E-04	3.47E-04
2W24	Pu-239	4.49E-02	5.62E-03
2W24	Ru-106	1.30E-01	1.50E-01
2W24	Sr-90	1.65E-01	3.46E-02
2W24	Tc-99	1.60E-01	1.17E+00
2W24	U	8.26E-01	2.34E-01
2W24	Zn-65	-0.145	5.36E-02
2W24	Zr-95	-0.00569	5.36E-02

Table E-1. Grid Site Soil Results for 200 West Area for 1989 (pCi/g dry weight). (sheet 5 of 6)

Location	Nuclide	Result	+/- Error
2W28	Ce-141	1.48E-02	8.19E-02
2W28	Ce-144	-0.0421	1.01E-01
2W28	Co-58	-0.0199	2.58E-02
2W28	Co-60	3.76E-03	1.36E-02
2W28	Cs-134	-0.00452	1.73E-02
2W28	Cs-137	3.99E+00	4.11E-01
2W28	Eu-152	6.31E-02	5.99E-02
2W28	Eu-154	7.58E-03	4.20E-02
2W28	Eu-155	3.38E-02	5.24E-02
2W28	I-129	-0.137	5.78E-01
2W28	K-40	1.17E+01	1.36E+00
2W28	Mn-54	3.59E-04	1.74E-02
2W28	Nb-95	-0.0357	5.98E-02
2W28	Pb-212	5.89E-01	7.29E-02
2W28	Pb-214	4.96E-01	8.39E-02
2W28	Pu-238	3.52E-03	7.65E-04
2W28	Pu-239	1.96E-02	2.57E-03
2W28	Ru-106	6.05E-02	1.61E-01
2W28	Sr-90	1.28E+00	2.61E-01
2W28	Tc-99	2.17E-01	1.17E+00
2W28	U	3.05E-01	9.66E-02
2W28	Zn-65	-0.0319	3.93E-02
2W28	Zr-95	3.18E-03	4.85E-02
2W30	Ce-141	-0.0311	8.34E-02
2W30	Ce-144	3.34E-02	9.87E-02
2W30	Co-58	1.57E-02	2.72E-02
2W30	Co-60	5.45E-03	1.54E-02
2W30	Cs-134	-0.0156	1.59E-02
2W30	Cs-137	8.16E-01	9.48E-02
2W30	Eu-152	7.77E-02	8.66E-02
2W30	Eu-154	2.04E-02	4.98E-02
2W30	Eu-155	3.61E-02	4.99E-02
2W30	I-129	-0.253	3.32E-01
2W30	K-40	1.52E+01	1.71E+00
2W30	Mn-54	7.92E-03	1.83E-02
2W30	Nb-95	-0.0287	6.61E-02
2W30	Pb-212	7.92E-01	9.01E-02
2W30	Pb-214	6.42E-01	8.71E-02
2W30	Pu-238	2.60E-03	5.66E-04
2W30	Pu-239	6.36E-02	6.74E-03
2W30	Ru-106	7.96E-03	1.46E-01
2W30	Sr-90	2.36E-01	4.80E-02
2W30	Tc-99	1.64E-01	1.17E+00
2W30	U	8.91E-01	2.53E-01
2W30	Zn-65	-0.0494	5.11E-02
2W30	Zr-95	-0.0278	5.64E-02

Table E-1. Grid Site Soil Results for 200 West Area for 1989 (pCi/g dry weight). (sheet 6 of 6)

Location	Nuclide	Result	+/- Error
2W33	Ce-141	-0.0135	8.62E-02
2W33	Ce-144	-0.0207	1.06E-01
2W33	Co-58	1.83E-02	2.53E-02
2W33	Co-60	1.48E-02	1.68E-02
2W33	Cs-134	-0.0392	2.00E-02
2W33	Cs-137	1.93E+00	2.04E-01
2W33	Eu-152	4.79E-02	7.58E-02
2W33	Eu-154	-0.043	5.92E-02
2W33	Eu-155	3.78E-02	5.33E-02
2W33	I-129	-0.0395	2.97E-01
2W33	K-40	1.47E+01	1.63E+00
2W33	Mn-54	1.95E-02	1.43E-02
2W33	Nb-95	-0.0187	6.77E-02
2W33	Pb-212	7.36E-01	8.48E-02
2W33	Pb-214	5.40E-01	7.46E-02
2W33	Pu-238	5.30E-03	8.85E-04
2W33	Pu-239	1.27E-01	1.30E-02
2W33	Ru-106	-0.0228	1.65E-01
2W33	Sr-90	5.59E-01	1.10E-01
2W33	Tc-99	1.40E-01	1.17E+00
2W33	U	3.60E-01	1.11E-01
2W33	Zn-65	-0.127	5.43E-02
2W33	Zr-95	-0.00872	5.34E-02
2W34	Ce-141	3.58E-02	6.89E-02
2W34	Ce-144	-0.042	8.84E-02
2W34	Co-58	-0.00153	2.52E-02
2W34	Co-60	9.46E-03	1.24E-02
2W34	Cs-134	9.89E-03	1.28E-02
2W34	Cs-137	8.23E-01	9.50E-02
2W34	Eu-152	5.31E-02	6.41E-02
2W34	Eu-154	-0.00442	4.55E-02
2W34	Eu-155	5.89E-02	4.77E-02
2W34	I-129	-0.37	4.94E-01
2W34	K-40	1.33E+01	1.50E+00
2W34	Mn-54	9.41E-04	1.59E-02
2W34	Nb-95	-0.052	5.95E-02
2W34	Pb-212	7.42E-01	8.50E-02
2W34	Pb-214	5.27E-01	7.27E-02
2W34	Pu-238	2.81E-01	2.78E-02
2W34	Pu-239	8.25E-02	8.46E-03
2W34	Ru-106	8.89E-02	1.39E-01
2W34	Sr-90	6.22E-01	1.19E-01
2W34	Tc-99	-0.151	1.14E+00
2W34	U	4.83E-01	1.44E-01
2W34	Zn-65	-0.0189	3.91E-02
2W34	Zr-95	2.23E-02	5.07E-02

Table E-2. Grid Site Soil Results for 200 West Area for 1989 (pCi/g dry weight).

Nuclide	MAXIMUM	MINIMUM	AVERAGE
Ce-141	8.30E-02	-0.0739	-4.32E-03
Ce-144	8.80E-02	-0.266	-0.024183
Co-58	1.83E-02	-0.0199	-1.22E-03
Co-60	2.42E-02	-0.00889	7.41E-03
Cs-134	9.89E-03	-0.106	-0.03466
Cs-137	5.80E+01	4.78E-01	1.11E+01
Eu-152	1.23E-01	0.0174	5.99E-02
Eu-154	7.03E-02	-0.0616	1.17E-02
Eu-155	7.43E-02	-1.14E-01	2.14E-02
I-129	2.76E-01	-1.48	-0.289025
K-40	1.59E+01	1.16E+01	1.38E+01
Mn-54	2.77E-02	-0.00207	8.32E-03
Nb-95	3.02E-02	-0.102	-0.037918
Pb-212	8.09E-01	4.99E-01	6.95E-01
Pb-214	7.34E-01	4.96E-01	5.88E-01
Pu-238	2.81E-01	4.50E-04	2.85E-02
Pu-239	1.53E+00	1.13E-02	3.32E-01
Ru-106	2.47E-01	-0.0718	5.87E-02
Sr-90	1.54E+00	1.27E-01	6.76E-01
Tc-99	2.35E-01	-1.51E-01	5.16E-02
U	8.91E-01	2.06E-01	4.65E-01
Zn-65	-0.00187	-0.222	-0.089005
Zr-95	8.75E-02	-0.0278	1.17E-02

Note: Negative values indicate concentrations at or near background levels of radioactivity.

Table E-3. Grid Site Soil Results for 200 East Area for 1989 (pCi/g dry weight). (sheet 1 of 11)

Location	Nuclide	Result	+/- Error
2E3	Ce-141	-0.0506	1.53E-01
2E3	Ce-144	-0.00168	2.40E-01
2E3	Co-58	3.34E-03	3.06E-02
2E3	Co-60	1.44E-02	1.87E-02
2E3	Cs-134	-0.009	3.59E-02
2E3	Cs-137	2.99E+01	3.00E+00
2E3	Eu-152	1.39E-01	1.02E-01
2E3	Eu-154	9.04E-03	6.95E-02
2E3	Eu-155	1.65E-01	1.28E-01
2E3	I-129	-1.68	6.47E-01
2E3	K-40	1.52E+01	1.75E+00
2E3	Mn-54	1.83E-02	2.21E-02
2E3	Nb-95	-0.0412	7.22E-02
2E3	Pb-212	8.84E-01	1.17E-01
2E3	Pb-214	7.28E-01	1.32E-01
2E3	Pu-238	1.64E-03	4.31E-04
2E3	Pu-239	4.21E-02	4.61E-03
2E3	Ru-106	-0.0859	3.92E-01
2E3	Sr-90	1.13E+00	2.22E-01
2E3	Tc-99	4.80E-01	1.08E+00
2E3	U	2.18E-01	7.12E-02
2E3	Zn-65	-0.113	6.68E-02
2E3	Zr-95	3.71E-04	5.97E-02
2E4	Ce-141	-0.019	1.41E-01
2E4	Ce-144	-0.101	2.10E-01
2E4	Co-58	3.64E-03	2.58E-02
2E4	Co-60	2.14E-02	2.25E-02
2E4	Cs-134	-0.0161	3.31E-02
2E4	Cs-137	1.99E+01	2.00E+00
2E4	Eu-152	5.42E-02	1.02E-01
2E4	Eu-154	4.33E-02	6.50E-02
2E4	Eu-155	8.68E-02	1.22E-01
2E4	I-129	-0.209	3.33E-01
2E4	K-40	1.36E+01	1.57E+00
2E4	Mn-54	3.88E-03	1.85E-02
2E4	Nb-95	-0.101	6.67E-02
2E4	Pb-212	8.61E-01	1.14E-01
2E4	Pb-214	6.76E-01	1.29E-01
2E4	Pu-238	9.61E-04	3.49E-04
2E4	Pu-239	4.89E-02	5.43E-03
2E4	Ru-106	9.16E-02	3.34E-01
2E4	Sr-90	3.80E-01	7.84E-02
2E4	Tc-99	6.64E-02	1.05E+00
2E4	U	4.17E-01	1.26E-01
2E4	Zn-65	-0.122	6.34E-02
2E4	Zr-95	2.29E-02	5.00E-02

Table E-3. Grid Site Soil Results for 200 East Area for 1989 (pCi/g dry weight). (sheet 2 of 11)

Location	Nuclide	Result	+/- Error
2E8	Ce-141	7.03E-02	9.61E-02
2E8	Ce-144	-0.106	1.50E-01
2E8	Co-58	2.05E-02	2.60E-02
2E8	Co-60	-0.0152	2.05E-02
2E8	Cs-134	2.46E-03	2.01E-02
2E8	Cs-137	6.51E+00	6.65E-01
2E8	Eu-152	7.84E-02	8.39E-02
2E8	Eu-154	8.79E-02	5.43E-02
2E8	Eu-155	4.47E-02	6.55E-02
2E8	I-129	-0.176	4.28E-01
2E8	K-40	1.38E+01	1.59E+00
2E8	Mn-54	2.47E-02	2.12E-02
2E8	Nb-95	-0.156	6.08E-02
2E8	Pb-212	8.95E-01	1.05E-01
2E8	Pb-214	7.10E-01	1.03E-01
2E8	Pu-238	2.21E-03	5.28E-04
2E8	Pu-239	6.63E-02	7.05E-03
2E8	Ru-106	1.18E-02	2.06E-01
2E8	Sr-90	4.13E-01	7.75E-02
2E8	Tc-99	4.85E-01	1.08E+00
2E8	U	3.16E-01	9.71E-02
2E8	Zn-65	-0.0424	4.95E-02
2E8	Zr-95	3.05E-02	5.74E-02
2E9	Ce-141	-0.081	1.05E-01
2E9	Ce-144	4.49E-02	1.56E-01
2E9	Co-58	-0.00864	2.10E-02
2E9	Co-60	-0.015	1.59E-02
2E9	Cs-134	-0.106	2.77E-02
2E9	Cs-137	1.79E+01	1.80E+00
2E9	Eu-152	9.98E-02	5.89E-02
2E9	Eu-154	-0.0223	5.20E-02
2E9	Eu-155	1.08E-04	7.73E-02
2E9	I-129	8.29E-02	2.85E-01
2E9	K-40	1.32E+01	1.46E+00
2E9	Mn-54	8.30E-03	1.59E-02
2E9	Nb-95	-0.0588	4.97E-02
2E9	Pb-212	6.87E-01	8.48E-02
2E9	Pb-214	5.64E-01	9.18E-02
2E9	Pu-238	2.09E-03	5.08E-04
2E9	Pu-239	2.58E-02	3.03E-03
2E9	Ru-106	1.71E-01	2.30E-01
2E9	Sr-90	2.90E+00	5.46E-01
2E9	Tc-99	3.28E-01	1.07E+00
2E9	U	3.43E-01	1.05E-01
2E9	Zn-65	-0.139	5.00E-02
2E9	Zr-95	-0.00116	4.56E-02

Table E-3. Grid Site Soil Results for 200 East Area for 1989 (pCi/g dry weight). (sheet 3 of 11)

Location	Nuclide	Result	+/- Error
2E10	Ce-141	4.55E-02	1.25E-01
2E10	Ce-144	1.40E-01	1.88E-01
2E10	Co-58	7.86E-03	3.37E-02
2E10	Co-60	4.79E-03	2.00E-02
2E10	Cs-134	1.85E-02	2.39E-02
2E10	Cs-137	7.06E+00	7.22E-01
2E10	Eu-152	1.06E-01	1.07E-01
2E10	Eu-154	1.60E-03	7.04E-02
2E10	Eu-155	2.81E-02	1.08E-01
2E10	I-129	5.53E-02	2.61E-01
2E10	K-40	1.51E+01	1.76E+00
2E10	Mn-54	1.11E-02	2.21E-02
2E10	Nb-95	3.61E-02	7.24E-02
2E10	Pb-212	8.71E-01	1.08E-01
2E10	Pb-214	7.50E-01	1.14E-01
2E10	Pu-238	1.25E-03	4.31E-04
2E10	Pu-239	2.66E-02	3.36E-03
2E10	Ru-106	2.39E-02	2.62E-01
2E10	Sr-90	7.00E-01	1.45E-01
2E10	Tc-99	3.33E-01	1.07E+00
2E10	U	3.97E-01	1.19E-01
2E10	Zn-65	7.31E-03	5.86E-02
2E10	Zr-95	9.51E-02	6.88E-02
2E12	Ce-141	1.02E-01	1.51E-01
2E12	Ce-144	1.45E-01	2.29E-01
2E12	Co-58	8.28E-03	2.72E-02
2E12	Co-60	1.69E-02	2.29E-02
2E12	Cs-134	2.73E-02	3.30E-02
2E12	Cs-137	2.35E+01	2.36E+00
2E12	Eu-152	1.75E-02	1.03E-01
2E12	Eu-154	2.54E-02	7.07E-02
2E12	Eu-155	4.85E-02	1.02E-01
2E12	I-129	2.37E-02	2.79E-01
2E12	K-40	1.19E+01	1.46E+00
2E12	Mn-54	1.24E-02	2.47E-02
2E12	Nb-95	1.21E-01	6.42E-02
2E12	Pb-212	7.85E-01	1.07E-01
2E12	Pb-214	6.42E-01	1.30E-01
2E12	Pu-238	4.18E-03	7.82E-04
2E12	Pu-239	1.05E-01	1.10E-02
2E12	Ru-106	1.98E-01	3.22E-01
2E12	Sr-90	1.67E+00	3.20E-01
2E12	Tc-99	3.41E-01	1.07E+00
2E12	U	1.92E-01	6.32E-02
2E12	Zn-65	2.27E-02	5.80E-02
2E12	Zr-95	3.52E-02	6.06E-02

Table E-3. Grid Site Soil Results for 200 East Area for 1989 (pCi/g dry weight). (sheet 4 of 11)

Location	Nuclide	Result	+/- Error
2E13	Ce-141	3.44E-02	6.34E-02
2E13	Ce-144	8.11E-02	8.34E-02
2E13	Co-58	5.16E-03	2.26E-02
2E13	Co-60	1.67E-03	1.46E-02
2E13	Cs-134	5.33E-02	1.64E-02
2E13	Cs-137	4.08E-01	5.10E-02
2E13	Eu-152	9.26E-02	6.18E-02
2E13	Eu-154	4.67E-02	4.87E-02
2E13	Eu-155	2.24E-02	4.42E-02
2E13	I-129	9.19E-02	3.50E-01
2E13	K-40	1.36E+01	1.49E+00
2E13	Mn-54	9.04E-03	1.48E-02
2E13	Nb-95	2.31E-02	4.94E-02
2E13	Pb-212	6.37E-01	7.27E-02
2E13	Pb-214	5.05E-01	6.60E-02
2E13	Pu-238	5.19E-05	8.00E-05
2E13	Pu-239	8.31E-03	1.19E-03
2E13	Ru-106	5.66E-02	1.33E-01
2E13	Sr-90	1.18E-01	2.42E-02
2E13	Tc-99	9.95E-01	1.12E+00
2E13	U	2.39E-01	7.59E-02
2E13	Zn-65	9.93E-02	4.63E-02
2E13	Zr-95	3.21E-02	4.20E-02
2E14	Ce-141	1.79E-02	8.13E-02
2E14	Ce-144	6.71E-03	1.11E-01
2E14	Co-58	1.12E-02	2.99E-02
2E14	Co-60	1.23E-02	1.75E-02
2E14	Cs-134	9.01E-03	1.51E-02
2E14	Cs-137	1.01E+00	1.13E-01
2E14	Eu-152	5.16E-02	7.55E-02
2E14	Eu-154	4.38E-03	5.85E-02
2E14	Eu-155	5.22E-02	5.32E-02
2E14	I-129	8.64E-02	3.76E-01
2E14	K-40	1.48E+01	1.66E+00
2E14	Mn-54	2.58E-03	1.90E-02
2E14	Nb-95	1.03E-01	6.69E-02
2E14	Pb-212	7.85E-01	9.05E-02
2E14	Pb-214	6.92E-01	9.22E-02
2E14	Pu-238	1.90E-04	1.58E-04
2E14	Pu-239	1.91E-02	2.46E-03
2E14	Ru-106	1.08E-01	1.59E-01
2E14	Sr-90	1.25E-01	2.58E-02
2E14	Tc-99	3.43E-02	1.04E+00
2E14	U	3.56E-01	1.08E-01
2E14	Zn-65	4.83E-02	4.76E-02
2E14	Zr-95	4.96E-02	5.42E-02

Table E-3. Grid Site Soil Results for 200 East Area for 1989 (pCi/g dry weight). (sheet 5 of 11)

Location	Nuclide	Result	+/- Error
2E17	Ce-141	6.65E-02	9.90E-02
2E17	Ce-144	6.51E-02	1.27E-01
2E17	Co-58	8.00E-03	2.67E-02
2E17	Co-60	7.69E-03	1.89E-02
2E17	Cs-134	4.23E-02	2.16E-02
2E17	Cs-137	4.07E+00	4.19E-01
2E17	Eu-152	1.19E-01	8.41E-02
2E17	Eu-154	3.35E-02	5.68E-02
2E17	Eu-155	4.67E-02	7.11E-02
2E17	I-129	3.55E-02	2.63E-01
2E17	K-40	1.50E+01	1.69E+00
2E17	Mn-54	5.78E-04	2.07E-02
2E17	Nb-95	7.69E-02	6.96E-02
2E17	Pb-212	7.90E-01	9.26E-02
2E17	Pb-214	6.17E-01	8.87E-02
2E17	Pu-238	4.81E-04	2.60E-04
2E17	Pu-239	4.09E-02	4.70E-03
2E17	Ru-106	2.05E-01	1.94E-01
2E17	Sr-90	3.10E+00	6.17E-01
2E17	Tc-99	2.35E-01	1.06E+00
2E17	U	2.88E-01	9.07E-02
2E17	Zn-65	8.76E-02	5.61E-02
2E17	Zr-95	2.90E-02	5.98E-02
2E18	Ce-141	1.35E-03	9.21E-02
2E18	Ce-144	-0.0271	1.25E-01
2E18	Co-58	8.06E-03	2.50E-02
2E18	Co-60	7.46E-03	1.55E-02
2E18	Cs-134	5.57E-03	1.72E-02
2E18	Cs-137	7.96E+00	8.06E-01
2E18	Eu-152	1.79E-02	8.11E-02
2E18	Eu-154	3.95E-03	4.98E-02
2E18	Eu-155	5.98E-02	6.07E-02
2E18	I-129	1.85E-01	4.53E-01
2E18	K-40	1.51E+01	1.67E+00
2E18	Mn-54	1.06E-02	1.74E-02
2E18	Nb-95	3.44E-02	6.23E-02
2E18	Pb-212	7.48E-01	8.78E-02
2E18	Pb-214	7.48E-01	1.02E-01
2E18	Pu-238	2.23E-04	1.62E-04
2E18	Pu-239	1.49E-02	1.95E-03
2E18	Ru-106	-0.0882	1.79E-01
2E18	Sr-90	2.40E+00	4.75E-01
2E18	Tc-99	6.86E-01	1.10E+00
2E18	U	4.08E-01	1.23E-01
2E18	Zn-65	-0.0707	4.70E-02
2E18	Zr-95	2.48E-02	4.96E-02

Table E-3. Grid Site Soil Results for 200 East Area for 1989 (pCi/g dry weight). (sheet 6 of 11)

Location	Nuclide	Result	+/- Error
2E20	Ce-141	5.20E-02	1.27E-01
2E20	Ce-144	-0.0631	1.69E-01
2E20	Co-58	1.91E-02	2.88E-02
2E20	Co-60	1.45E-02	1.92E-02
2E20	Cs-134	-0.0506	2.86E-02
2E20	Cs-137	8.31E+00	8.44E-01
2E20	Eu-152	4.58E-02	9.61E-02
2E20	Eu-154	-0.00594	6.89E-02
2E20	Eu-155	8.74E-02	9.11E-02
2E20	I-129	-0.594	4.82E-01
2E20	K-40	1.51E+01	1.71E+00
2E20	Mn-54	1.19E-02	2.06E-02
2E20	Nb-95	-0.00037	7.78E-02
2E20	Pb-212	7.79E-01	9.64E-02
2E20	Pb-214	6.44E-01	1.04E-01
2E20	Pu-238	6.43E-04	2.62E-04
2E20	Pu-239	3.82E-02	4.24E-03
2E20	Ru-106	1.22E-01	2.40E-01
2E20	Sr-90	1.47E+00	2.90E-01
2E20	Tc-99	1.26E-01	1.05E+00
2E20	U	3.73E-01	1.13E-01
2E20	Zn-65	-0.144	6.74E-02
2E20	Zr-95	2.27E-02	6.13E-02
2E24	Ce-141	2.97E-02	1.17E-01
2E24	Ce-144	-0.0194	1.44E-01
2E24	Co-58	2.87E-03	2.43E-02
2E24	Co-60	3.09E-03	1.71E-02
2E24	Cs-134	6.50E-03	1.52E-02
2E24	Cs-137	9.68E-01	1.12E-01
2E24	Eu-152	6.49E-02	8.95E-02
2E24	Eu-154	-0.00389	4.50E-02
2E24	Eu-155	2.35E-02	8.05E-02
2E24	I-129	1.74E-01	2.59E-01
2E24	K-40	1.37E+01	1.60E+00
2E24	Mn-54	-0.0131	1.83E-02
2E24	Nb-95	-0.107	6.58E-02
2E24	Pb-212	8.55E-01	1.00E-01
2E24	Pb-214	6.84E-01	9.64E-02
2E24	Pu-238	7.92E-04	2.89E-04
2E24	Pu-239	3.35E-02	3.75E-03
2E24	Ru-106	-0.0861	1.68E-01
2E24	Sr-90	2.19E-01	4.37E-02
2E24	Tc-99	3.25E-01	1.07E+00
2E24	U	3.27E-01	1.02E-01
2E24	Zn-65	-0.0172	4.08E-02
2E24	Zr-95	2.01E-02	5.19E-02

Table E-3. Grid Site Soil Results for 200 East Area for 1989 (pCi/g dry weight). (sheet 7 of 11)

Location	Nuclide	Result	+/- Error
2E29	Ce-141	3.03E-02	7.97E-02
2E29	Ce-144	-0.045	1.02E-01
2E29	Co-58	1.53E-02	2.65E-02
2E29	Co-60	5.42E-03	1.70E-02
2E29	Cs-134	-0.00763	1.69E-02
2E29	Cs-137	1.93E+00	2.07E-01
2E29	Eu-152	5.63E-02	6.98E-02
2E29	Eu-154	3.97E-03	5.14E-02
2E29	Eu-155	1.43E-02	5.52E-02
2E29	I-129	1.74E-01	3.09E-01
2E29	K-40	1.54E+01	1.74E+00
2E29	Mn-54	-0.0101	1.96E-02
2E29	Nb-95	-0.0327	7.08E-02
2E29	Pb-212	8.75E-01	1.01E-01
2E29	Pb-214	6.67E-01	9.09E-02
2E29	Pu-238	1.24E-03	3.70E-04
2E29	Pu-239	5.06E-02	5.48E-03
2E29	Ru-106	1.30E-01	1.79E-01
2E29	Sr-90	3.32E-01	6.28E-02
2E29	Tc-99	2.24E-01	1.06E+00
2E29	U	4.82E-01	1.42E-01
2E29	Zn-65	-0.0187	4.41E-02
2E29	Zr-95	-0.0222	5.98E-02
2E30	Ce-141	-0.0498	7.60E-02
2E30	Ce-144	-0.0486	9.92E-02
2E30	Co-58	3.24E-04	2.47E-02
2E30	Co-60	-0.00184	1.45E-02
2E30	Cs-134	-0.0736	1.93E-02
2E30	Cs-137	3.41E-01	4.66E-02
2E30	Eu-152	9.74E-02	7.13E-02
2E30	Eu-154	-0.0469	5.44E-02
2E30	Eu-155	7.85E-02	5.03E-02
2E30	I-129	6.30E-02	4.65E-01
2E30	K-40	1.35E+01	1.51E+00
2E30	Mn-54	-0.00448	1.70E-02
2E30	Nb-95	-0.0114	6.82E-02
2E30	Pb-212	7.04E-01	8.07E-02
2E30	Pb-214	6.02E-01	7.97E-02
2E30	Pu-238	2.68E-03	5.62E-04
2E30	Pu-239	3.53E-02	3.89E-03
2E30	Ru-106	3.28E-01	1.52E-01
2E30	Sr-90	2.03E-01	4.31E-02
2E30	Tc-99	1.66E-01	1.05E+00
2E30	U	5.56E-01	1.62E-01
2E30	Zn-65	-0.0923	5.26E-02
2E30	Zr-95	3.36E-02	5.22E-02

Table E-3. Grid Site Soil Results for 200 East Area for 1989 (pCi/g dry weight). (sheet 8 of 11)

Location	Nuclide	Result	+/- Error
2EC	Ce-141	9.10E-03	8.84E-02
2EC	Ce-144	-0.0551	1.04E-01
2EC	Co-58	-0.0163	2.98E-02
2EC	Co-60	1.39E-02	1.43E-02
2EC	Cs-134	5.50E-03	1.57E-02
2EC	Cs-137	1.61E+00	1.74E-01
2EC	Eu-152	8.95E-02	8.76E-02
2EC	Eu-154	-0.03	5.97E-02
2EC	Eu-155	6.68E-02	5.16E-02
2EC	I-129	-0.182	3.28E-01
2EC	K-40	1.51E+01	1.70E+00
2EC	Mn-54	1.11E-02	1.92E-02
2EC	Nb-95	-0.067	8.04E-02
2EC	Pb-212	8.21E-01	9.37E-02
2EC	Pb-214	6.45E-01	8.78E-02
2EC	Pu-238	3.05E-04	2.07E-04
2EC	Pu-239	1.63E-02	2.23E-03
2EC	Ru-106	-0.0762	1.59E-01
2EC	Sr-90	3.21E-01	6.53E-02
2EC	Tc-99	2.72E-01	1.03E+00
2EC	U	3.24E-01	1.01E-01
2EC	Zn-65	-0.00251	4.54E-02
2EC	Zr-95	2.16E-02	6.18E-02
2ED	Ce-141	-0.0274	8.64E-02
2ED	Ce-144	-0.0557	1.06E-01
2ED	Co-58	2.44E-02	2.57E-02
2ED	Co-60	-0.00891	1.56E-02
2ED	Cs-134	1.29E-03	1.40E-02
2ED	Cs-137	2.42E+00	2.53E-01
2ED	Eu-152	1.29E-01	7.95E-02
2ED	Eu-154	3.94E-02	5.77E-02
2ED	Eu-155	6.19E-02	5.08E-02
2ED	I-129	-0.252	5.34E-01
2ED	K-40	1.63E+01	1.79E+00
2ED	Mn-54	-0.015	1.83E-02
2ED	Nb-95	-0.0684	7.10E-02
2ED	Pb-212	7.70E-01	8.71E-02
2ED	Pb-214	6.76E-01	8.82E-02
2ED	Pu-238	1.60E-04	1.35E-04
2ED	Pu-239	1.80E-02	2.24E-03
2ED	Ru-106	7.01E-02	1.48E-01
2ED	Sr-90	4.51E-01	9.42E-02
2ED	Tc-99	2.30E-01	1.03E+00
2ED	U	3.56E-01	1.09E-01
2ED	Zn-65	-0.0864	4.89E-02
2ED	Zr-95	3.73E-02	5.25E-02

Table E-3. Grid Site Soil Results for 200 East Area for 1989 (pCi/g dry weight). (sheet 9 of 11)

Location	Nuclide	Result	+/- Error
GRT1	Ce-141	-0.0337	8.04E-02
GRT1	Ce-144	-0.016	1.03E-01
GRT1	Co-58	1.74E-02	2.47E-02
GRT1	Co-60	-0.0109	1.57E-02
GRT1	Cs-134	-0.00046	1.47E-02
GRT1	Cs-137	1.98E+00	2.09E-01
GRT1	Eu-152	1.35E-01	8.53E-02
GRT1	Eu-154	-0.017	5.03E-02
GRT1	Eu-155	4.48E-02	5.03E-02
GRT1	I-129	-0.175	5.51E-01
GRT1	K-40	1.45E+01	1.62E+00
GRT1	Mn-54	2.05E-02	1.82E-02
GRT1	Nb-95	-0.0528	7.16E-02
GRT1	Pb-212	7.63E-01	8.72E-02
GRT1	Pb-214	5.97E-01	8.27E-02
GRT1	Pu-238	5.34E-04	2.31E-04
GRT1	Pu-239	2.00E-02	2.38E-03
GRT1	Ru-106	-0.0126	1.48E-01
GRT1	Sr-90	3.65E-01	7.02E-02
GRT1	Tc-99	4.92E-02	1.16E+00
GRT1	U	4.42E-01	1.33E-01
GRT1	Zn-65	-0.057	4.55E-02
GRT1	Zr-95	2.57E-02	5.11E-02
GRT2	Ce-141	2.47E-02	9.40E-02
GRT2	Ce-144	2.08E-03	1.12E-01
GRT2	Co-58	1.84E-02	2.58E-02
GRT2	Co-60	-0.0143	1.87E-02
GRT2	Cs-134	-0.053	2.07E-02
GRT2	Cs-137	1.19E+00	1.31E-01
GRT2	Eu-152	-0.0245	8.30E-02
GRT2	Eu-154	4.84E-02	6.34E-02
GRT2	Eu-155	3.09E-02	5.60E-02
GRT2	I-129	9.59E-02	4.68E-01
GRT2	K-40	1.42E+01	1.60E+00
GRT2	Mn-54	-0.00387	1.78E-02
GRT2	Nb-95	-0.0871	7.34E-02
GRT2	Pb-212	8.43E-01	9.71E-02
GRT2	Pb-214	6.04E-01	8.36E-02
GRT2	Pu-238	7.33E-04	2.93E-04
GRT2	Pu-239	9.48E-03	1.39E-03
GRT2	Ru-106	5.72E-02	1.69E-01
GRT2	Sr-90	1.83E-01	3.52E-02
GRT2	Tc-99	2.47E-01	1.17E+00
GRT2	U	4.51E-01	1.34E-01
GRT2	Zn-65	-0.16	6.10E-02
GRT2	Zr-95	4.95E-02	6.43E-02

Table E-3. Grid Site Soil Results for 200 East Area for 1989 (pCi/g dry weight). (sheet 10 of 11)

Location	Nuclide	Result	+/- Error
GRT4	Ce-141	2.24E-02	7.90E-02
GRT4	Ce-144	2.49E-02	9.69E-02
GRT4	Co-58	1.10E-02	2.53E-02
GRT4	Co-60	-0.0282	1.82E-02
GRT4	Cs-134	-0.081	1.97E-02
GRT4	Cs-137	5.26E-01	6.43E-02
GRT4	Eu-152	8.71E-02	7.78E-02
GRT4	Eu-154	1.16E-02	5.12E-02
GRT4	Eu-155	3.24E-02	4.93E-02
GRT4	I-129	-0.0987	4.90E-01
GRT4	K-40	1.51E+01	1.67E+00
GRT4	Mn-54	-0.00694	1.84E-02
GRT4	Nb-95	-0.0289	6.53E-02
GRT4	Pb-212	7.91E-01	8.86E-02
GRT4	Pb-214	5.98E-01	7.77E-02
GRT4	Pu-238	6.64E-04	3.05E-04
GRT4	Pu-239	7.35E-03	1.24E-03
GRT4	Ru-106	5.74E-02	1.40E-01
GRT4	Sr-90	1.80E-01	3.53E-02
GRT4	Tc-99	4.23E-01	1.04E+00
GRT4	U	3.24E-01	9.97E-02
GRT4	Zn-65	-0.0995	4.99E-02
GRT4	Zr-95	2.23E-02	5.46E-02
GRT5	Ce-141	-0.0247	8.02E-02
GRT5	Ce-144	-0.00136	9.95E-02
GRT5	Co-58	-0.0234	2.93E-02
GRT5	Co-60	1.24E-02	1.64E-02
GRT5	Cs-134	9.82E-03	1.54E-02
GRT5	Cs-137	2.33E+00	2.44E-01
GRT5	Eu-152	4.24E-02	7.41E-02
GRT5	Eu-154	-0.0409	5.44E-02
GRT5	Eu-155	2.35E-02	5.31E-02
GRT5	I-129	-0.337	5.73E-01
GRT5	K-40	1.48E+01	1.65E+00
GRT5	Mn-54	5.56E-03	1.93E-02
GRT5	Nb-95	-0.149	7.13E-02
GRT5	Pb-212	7.97E-01	9.25E-02
GRT5	Pb-214	6.51E-01	8.70E-02
GRT5	Pu-238	3.60E-04	1.92E-04
GRT5	Pu-239	1.84E-02	2.23E-03
GRT5	Ru-106	-0.00751	1.67E-01
GRT5	Sr-90	9.76E-01	1.91E-01
GRT5	Tc-99	5.62E-01	1.05E+00
GRT5	U	4.13E-01	1.25E-01
GRT5	Zn-65	-0.00942	5.14E-02
GRT5	Zr-95	0.00E+00	5.76E-02

Table E-3. Grid Site Soil Results for 200 East Area for 1989 (pCi/g dry weight). (sheet 11 of 11)

Location	Nuclide	Result	+/- Error
GRT6	Ce-141	-0.0563	8.22E-02
GRT6	Ce-144	-0.0548	1.10E-01
GRT6	Co-58	-0.0292	3.34E-02
GRT6	Co-60	1.20E-02	1.97E-02
GRT6	Cs-134	2.19E-03	1.78E-02
GRT6	Cs-137	1.70E+00	1.83E-01
GRT6	Eu-152	5.60E-02	7.58E-02
GRT6	Eu-154	-0.00917	6.06E-02
GRT6	Eu-155	2.62E-02	5.80E-02
GRT6	I-129	1.11E-01	3.24E-01
GRT6	K-40	1.50E+01	1.71E+00
GRT6	Mn-54	9.42E-03	2.28E-02
GRT6	Nb-95	-0.138	7.12E-02
GRT6	Pb-212	8.28E-01	9.69E-02
GRT6	Pb-214	6.68E-01	9.50E-02
GRT6	Pu-238	1.58E-04	1.44E-04
GRT6	Pu-239	1.02E-02	1.50E-03
GRT6	Ru-106	-0.0391	1.70E-01
GRT6	Sr-90	2.39E-01	4.64E-02
GRT6	Tc-99	3.59E-01	1.04E+00
GRT6	U	4.47E-01	1.34E-01
GRT6	Zn-65	-0.0236	5.45E-02
GRT6	Zr-95	7.18E-02	6.10E-02

Table E-4. Grid Site Soil Results for 200 East Area for 1989 (pCi/g dry weight).

Nuclide	MAXIMUM	MINIMUM	AVERAGE
Ce-141	1.02E-01	-0.081	7.79E-03
Ce-144	1.45E-01	-0.106	-0.00405
Co-58	2.44E-02	-0.0292	5.11E-03
Co-60	2.14E-02	-0.0282	2.55E-03
Cs-134	5.33E-02	-0.106	-0.010173
Cs-137	2.99E+01	3.41E-01	6.74E+00
Eu-152	1.39E-01	-0.0245	7.40E-02
Eu-154	8.79E-02	-0.0469	8.72E-03
Eu-155	1.65E-01	1.08E-04	4.97E-02
I-129	1.85E-01	-1.68	-0.120242
K-40	1.63E+01	1.19E+01	1.45E+01
Mn-54	2.47E-02	-0.015	5.07E-03
Nb-95	1.21E-01	-0.156	-0.033579
Pb-212	8.95E-01	6.37E-01	7.99E-01
Pb-214	7.50E-01	5.05E-01	6.51E-01
Pu-238	4.18E-03	5.19E-05	1.03E-03
Pu-239	1.05E-01	7.35E-03	3.12E-02
Ru-106	3.28E-01	-0.0882	5.88E-02
Sr-90	3.10E+00	1.18E-01	8.51E-01
Tc-99	9.95E-01	3.43E-02	3.32E-01
U	5.56E-01	1.92E-01	3.65E-01
Zn-65	9.93E-02	-0.16	-0.044405
Zr-95	9.51E-02	-0.0222	2.86E-02

Note: Negative values indicate concentrations at or near background levels of radioactivity.

Figure E-7. Yearly Averages for Cesium-137 in Soil.

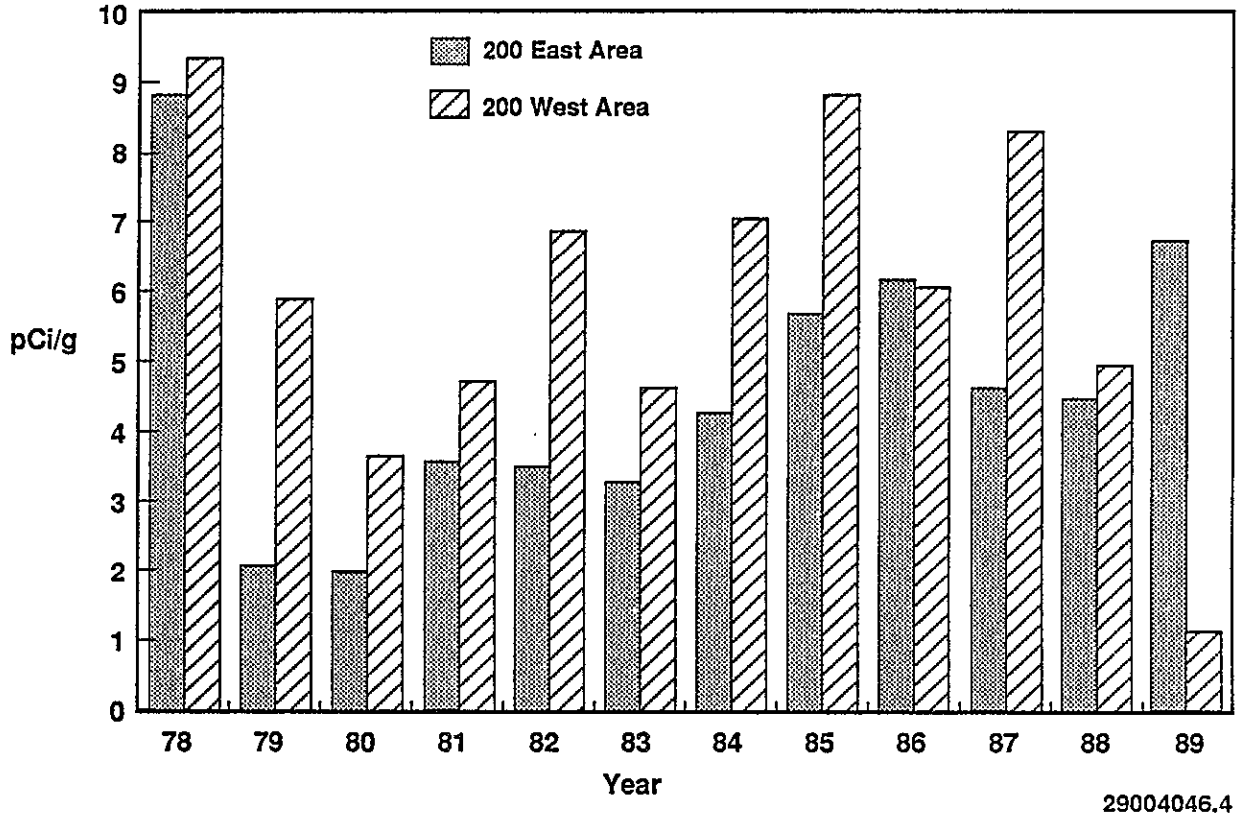


Figure E-8. Yearly Averages for Strontium-90 Soil.

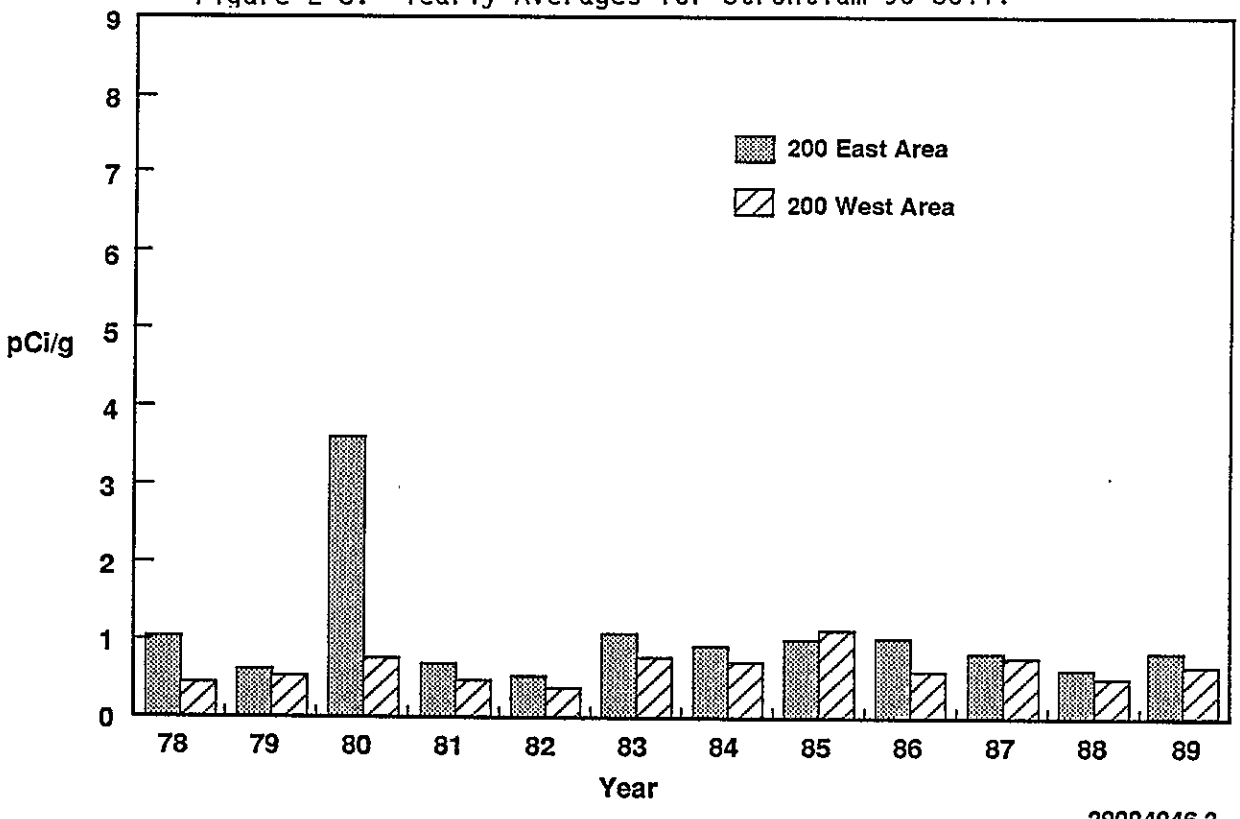


Figure E-9. Yearly Averages for Plutonium-239 in Soil.

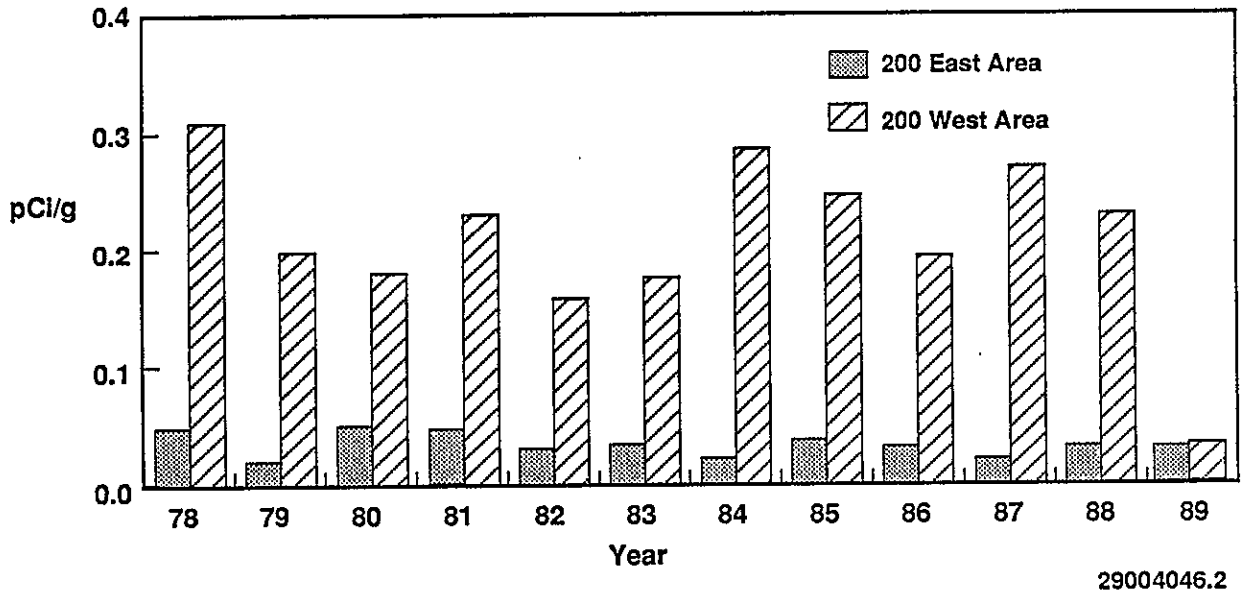


Table E-5. Soil Results for 200 Area Fencelines for 1989 (pCi/g dry weight). (sheet 1 of 4)

Sample Location	K-40	+/-Error	Co-60	+/-Error	Zn-65	+/-Error	Eu-152	+/-Error	Mn-54	+/-Error
2W N	1.44E+01	1.60E+00	-0.0118	1.63E-02	-0.0524	5.26E-02	3.21E-02	8.83E-02	1.50E-02	1.87E-02
2W NE	1.20E+01	1.36E+00	3.49E-03	1.43E-02	-0.0673	4.54E-02	4.22E-02	6.70E-02	-0.000935	1.60E-02
2W SE	1.53E+01	1.71E+00	-0.002	1.90E-02	-0.121	5.99E-02	6.29E-02	7.95E-02	2.26E-02	1.99E-02
S-TF-SE	1.38E+01	1.58E+00	-0.0066	1.87E-02	-0.00911	4.53E-02	1.45E-01	8.53E-02	1.52E-02	2.02E-02
S-TF-NE	1.45E+01	1.70E+00	9.62E-03	2.08E-02	-0.196	8.05E-02	1.02E-01	9.67E-02	2.45E-02	2.39E-02
S-TF-W	1.36E+01	1.54E+00	-0.0177	1.80E-02	-0.0328	5.05E-02	-0.0136	7.85E-02	1.96E-02	1.73E-02
U-TF-SE	1.45E+01	1.61E+00	1.33E-02	1.49E-02	-0.00558	4.30E-02	9.06E-02	6.45E-02	3.26E-03	1.82E-02
U-TF-W	1.44E+01	1.61E+00	4.35E-03	1.93E-02	-0.128	5.54E-02	7.98E-02	8.31E-02	5.50E-03	1.69E-02
U-TF-NE	1.39E+01	1.58E+00	2.12E-02	1.83E-02	-0.117	5.89E-02	1.65E-02	7.81E-02	1.10E-02	1.91E-02
2E N	1.58E+01	1.75E+00	4.66E-03	1.54E-02	-0.0685	4.72E-02	1.12E-01	6.62E-02	1.69E-02	1.77E-02
2E NE	1.38E+01	1.57E+00	8.39E-03	1.60E-02	-0.0207	4.95E-02	1.71E-02	8.30E-02	1.72E-02	1.93E-02
2E 1	1.32E+01	1.46E+00	7.06E-04	1.45E-02	-0.113	4.97E-02	4.16E-02	6.84E-02	1.16E-02	1.64E-02
2E 2	1.36E+01	1.52E+00	-0.0012	1.58E-02	-0.0369	4.26E-02	6.20E-02	6.74E-02	1.56E-02	1.61E-02
2E 3	1.43E+01	1.58E+00	5.46E-03	1.51E-02	-0.016	4.31E-02	1.28E-01	7.51E-02	5.33E-03	1.66E-02
2E SE	1.51E+01	1.68E+00	-0.00179	1.90E-02	-0.0747	4.79E-02	1.50E-01	7.30E-02	3.85E-03	1.70E-02
BX-TF-W	1.33E+01	1.53E+00	3.40E-03	1.74E-02	-0.0103	4.58E-02	4.10E-02	7.70E-02	1.55E-02	1.83E-02
B-TF-NE	1.39E+01	1.57E+00	1.48E-02	1.81E-02	-0.0763	4.85E-02	-0.0354	7.42E-02	-0.00963	1.89E-02
B-TF-SE	1.43E+01	1.61E+00	-0.0139	1.82E-02	-0.0834	5.76E-02	-0.0054	8.24E-02	1.24E-03	1.89E-02
C-TF-NE	1.45E+01	1.70E+00	-0.0025	2.18E-02	-0.0255	5.45E-02	6.01E-02	1.04E-01	8.29E-03	2.38E-02
C-TF-SE	1.56E+01	1.79E+00	1.91E-02	2.06E-02	-0.022	5.19E-02	3.37E-02	9.79E-02	4.42E-03	2.19E-02
A-TF-W #1	1.49E+01	1.77E+00	6.26E-03	2.16E-02	-0.0476	6.89E-02	7.88E-02	1.14E-01	1.22E-02	2.43E-02
A-TF-W #2	1.55E+01	1.77E+00	5.30E-03	2.17E-02	-0.102	7.19E-02	2.45E-02	9.71E-02	3.40E-03	2.28E-02
A-TF-E #1	1.21E+01	1.43E+00	1.10E-02	1.92E-02	-0.048	5.29E-02	2.55E-02	9.47E-02	5.05E-03	1.84E-02
A-TF-E #2	1.39E+01	1.55E+00	-0.00544	1.75E-02	-0.00327	4.57E-02	7.50E-02	7.45E-02	1.58E-02	1.90E-02
A-TF-E #3	1.51E+01	1.72E+00	-0.0249	1.89E-02	1.37E-02	4.50E-02	6.16E-02	7.50E-02	3.65E-02	2.84E-02
A-TF-E #4	1.29E+01	1.43E+00	-0.00266	1.36E-02	-0.0171	3.70E-02	-0.00692	6.99E-02	3.33E-03	1.53E-02

Note: Negetive values indicate concentrations at or near background levels of radioactivity.

Table E-5. Soil Results for 200 Area Fencelines for 1989 (pCi/g dry weight). (sheet 2 of 4)

Sample Location	Co-58	+/-Error	Nb-95	+/-Error	Zr-95	+/-Error	Cs-137	+/-Error	Cs-134	+/-Error
2W N	-0.0095	2.52E-02	-0.0752	6.19E-02	1.90E-02	5.25E-02	1.54E-01	2.80E-02	-0.0511	1.71E-02
2W NE	-0.0228	2.20E-02	-0.0352	5.33E-02	3.64E-02	4.47E-02	3.68E-01	4.80E-02	-0.0688	1.79E-02
2W SE	-0.0115	2.82E-02	-0.00592	6.49E-02	4.63E-02	5.49E-02	7.94E-01	9.07E-02	-0.0377	1.85E-02
S-TF-SE	-0.0115	2.86E-02	-0.0743	6.11E-02	-0.0275	5.28E-02	4.64E+01	4.65E+00	-0.0388	3.67E-02
S-TF-NE	4.47E-02	3.30E-02	6.43E-02	7.23E-02	2.51E-02	6.56E-02	8.00E-01	9.75E-02	-0.0469	2.33E-02
S-TF-W	-0.00158	2.51E-02	-0.0379	5.28E-02	1.13E-02	5.06E-02	4.48E+00	4.59E-01	-0.0119	1.88E-02
U-TF-SE	6.15E-03	2.38E-02	-0.0271	5.75E-02	1.53E-02	4.74E-02	1.85E+00	1.97E-01	-0.00809	1.34E-02
U-TF-W	-0.0168	2.60E-02	-0.0374	6.13E-02	2.92E-02	5.34E-02	1.78E+00	1.90E-01	-0.0732	2.06E-02
U-TF-NE	-0.0219	2.86E-02	-0.0265	6.36E-02	4.57E-02	5.93E-02	1.29E+02	1.29E+01	-0.00875	6.41E-02
2E N	7.90E-03	2.54E-02	1.34E-02	6.48E-02	-0.00364	5.38E-02	6.84E+00	6.95E-01	-0.0107	1.81E-02
2E NE	-0.00915	2.69E-02	-0.0463	6.43E-02	6.48E-03	5.31E-02	1.08E+00	1.20E-01	-0.00216	1.55E-02
2E 1	0.00E+00	2.37E-02	2.00E-03	5.15E-02	-0.00356	4.43E-02	4.85E+00	4.94E-01	-0.0515	1.94E-02
2E 2	-0.0122	2.17E-02	-0.0164	4.46E-02	-0.0252	4.19E-02	7.66E+00	7.76E-01	-0.00495	1.76E-02
2E 3	-0.00849	2.53E-02	-0.0415	5.45E-02	2.03E-02	4.83E-02	2.90E-01	3.94E-02	-0.00499	1.39E-02
2E SE	5.69E-03	2.48E-02	-0.0554	6.50E-02	2.49E-02	5.22E-02	1.34E+00	1.46E-01	1.11E-03	1.46E-02
BX-TF-W	-0.0203	2.74E-02	-0.068	6.89E-02	1.29E-02	5.15E-02	9.17E+00	9.30E-01	1.45E-02	1.93E-02
B-TF-NE	-0.00539	2.82E-02	-0.0371	6.65E-02	7.64E-02	6.37E-02	2.00E+02	2.00E+01	-0.0551	6.18E-02
B-TF-SE	7.19E-03	2.47E-02	-0.0484	6.28E-02	9.32E-03	5.44E-02	4.76E-01	6.04E-02	-0.0367	1.61E-02
C-TF-NE	-0.00393	3.42E-02	-0.0548	9.35E-02	-0.0252	7.46E-02	1.75E+01	1.76E+00	-0.0279	2.92E-02
C-TF-SE	5.39E-03	3.23E-02	-0.0814	8.43E-02	7.82E-02	6.41E-02	6.20E+01	6.21E+00	-0.0576	4.60E-02
A-TF-W #1	-0.0179	3.96E-02	-0.0425	8.78E-02	1.20E-02	8.00E-02	2.02E+00	2.22E-01	-0.0103	2.25E-02
A-TF-W #2	-0.0325	3.36E-02	-0.152	7.54E-02	5.20E-02	6.63E-02	3.19E-01	4.87E-02	5.47E-03	1.69E-02
A-TF-E #1	3.04E-02	2.79E-02	-0.0477	7.27E-02	-0.00953	6.06E-02	2.79E+00	2.94E-01	4.29E-03	1.88E-02
A-TF-E #2	1.88E-02	2.76E-02	-0.0521	6.66E-02	9.31E-04	5.67E-02	4.08E+00	4.18E-01	3.42E-03	1.88E-02
A-TF-E #3	5.98E-03	2.61E-02	-0.0816	6.65E-02	-0.0228	5.91E-02	7.09E+00	7.22E-01	1.36E-02	2.20E-02
A-TF-E #4	-0.0055	2.27E-02	-0.0298	5.57E-02	1.15E-02	4.75E-02	4.37E+00	4.46E-01	-0.00895	1.43E-02

Note: Negetive values indicate concentrations at or near background levels of radioactivity.

Table E-5. Soil Results for 200 Area Fencelines for 1989 (pCi/g dry weight). (sheet 3 of 4)

Sample Location	Ru-106	+/-Error	Ce-141	+/-Error	Ce-144	+/-Error	Eu-155	+/-Error	Eu-154	+/-Error
2W N	-0.096	1.34E-01	-0.0239	6.77E-02	-0.0554	9.28E-02	5.13E-02	5.28E-02	2.76E-02	5.52E-02
2W NE	1.74E-02	1.37E-01	-0.00188	6.46E-02	3.31E-03	8.61E-02	2.63E-02	4.47E-02	3.92E-02	5.14E-02
2W SE	1.19E-01	1.61E-01	3.38E-02	7.57E-02	8.95E-03	1.03E-01	6.01E-02	5.76E-02	8.69E-03	5.45E-02
S-TF-SE	1.32E-01	3.76E-01	-0.0891	1.93E-01	-0.237	2.77E-01	4.13E-02	1.19E-01	1.33E-02	5.71E-02
S-TF-NE	7.82E-02	1.95E-01	-0.0164	1.06E-01	4.17E-02	1.40E-01	2.77E-02	8.13E-02	3.14E-02	6.88E-02
S-TF-W	1.40E-01	1.90E-01	-0.0285	9.03E-02	6.16E-03	1.33E-01	2.24E-02	7.23E-02	6.92E-03	5.15E-02
U-TF-SE	1.70E-02	1.29E-01	-0.0399	7.21E-02	2.47E-02	9.64E-02	3.38E-02	4.82E-02	2.83E-02	5.64E-02
U-TF-W	2.46E-02	1.62E-01	1.13E-02	8.06E-02	-0.0198	1.10E-01	2.35E-02	5.52E-02	-0.0619	5.82E-02
U-TF-NE	-0.292	6.93E-01	-0.052	3.07E-01	8.14E-02	4.23E-01	6.63E-02	2.22E-01	-0.0395	6.32E-02
2E N	-0.145	1.82E-01	-0.0572	9.29E-02	-0.087	1.27E-01	6.19E-02	5.94E-02	-0.0563	5.37E-02
2E NE	-0.0235	1.53E-01	-0.0388	7.66E-02	1.67E-02	1.10E-01	2.00E-02	4.83E-02	1.21E-03	5.78E-02
2E 1	4.33E-02	1.60E-01	-0.024	8.26E-02	-0.000448	1.06E-01	2.32E-02	5.69E-02	-0.0174	4.67E-02
2E 2	3.73E-02	1.71E-01	5.23E-02	8.72E-02	-0.0445	1.17E-01	3.61E-03	5.73E-02	6.12E-02	4.40E-02
2E 3	2.11E-02	1.48E-01	-0.0194	6.85E-02	-0.0768	8.80E-02	5.17E-02	4.59E-02	-0.000333	5.06E-02
2E SE	6.05E-02	1.49E-01	1.81E-02	8.18E-02	-0.00894	1.06E-01	6.49E-02	5.46E-02	3.77E-02	5.39E-02
BX-TF-W	-0.017	2.03E-01	2.54E-02	1.17E-01	-0.122	1.54E-01	4.80E-02	7.87E-02	-0.0486	5.74E-02
B-TF-NE	-0.398	6.59E-01	-0.0508	3.48E-01	1.51E-01	4.52E-01	4.69E-02	2.10E-01	-0.0104	5.25E-02
B-TF-SE	9.21E-02	1.35E-01	-0.0696	7.72E-02	-0.0661	9.82E-02	1.88E-02	5.57E-02	-0.0157	5.65E-02
C-TF-NE	-0.246	3.14E-01	2.27E-02	1.65E-01	6.36E-03	2.00E-01	6.78E-02	8.75E-02	1.17E-02	6.53E-02
C-TF-SE	-0.305	4.58E-01	1.27E-02	2.56E-01	-0.132	3.20E-01	1.06E-01	1.53E-01	1.52E-03	6.05E-02
A-TF-W #1	1.13E-01	2.24E-01	-0.102	1.33E-01	9.25E-02	1.59E-01	5.74E-02	8.75E-02	1.10E-02	7.22E-02
A-TF-W #2	1.74E-01	1.87E-01	-0.0655	1.00E-01	-0.0479	1.32E-01	6.67E-02	7.42E-02	-0.0879	6.81E-02
A-TF-E #1	1.49E-01	1.91E-01	-0.0566	9.96E-02	-0.0639	1.17E-01	1.84E-02	5.98E-02	3.32E-02	5.92E-02
A-TF-E #2	1.31E-01	1.89E-01	4.05E-02	9.52E-02	-0.0402	1.24E-01	5.23E-02	5.41E-02	-0.0544	5.44E-02
A-TF-E #3	7.74E-02	2.40E-01	-0.0841	1.11E-01	-0.0847	1.46E-01	2.79E-02	8.32E-02	4.52E-02	4.69E-02
A-TF-E #4	3.67E-02	1.45E-01	5.17E-02	8.31E-02	-0.00731	1.07E-01	3.73E-02	5.26E-02	1.15E-02	5.07E-02

Note: Negetive values indicate concentrations at or near background levels of radioactivity.

Table E-5. Soil Results for 200 Area Fencelines for 1989 (pCi/g dry weight). (sheet 4 of 4)

Sample Location	Pb-212	+/-Error	Pb-214	+/-Error
2W N	7.99E-01	8.98E-02	5.92E-01	7.82E-02
2W NE	5.94E-01	6.92E-02	5.07E-01	6.77E-02
2W SE	7.55E-01	8.78E-02	6.01E-01	8.19E-02
S-TF-SE	6.32E-01	1.08E-01	5.07E-01	1.35E-01
S-TF-NE	7.62E-01	9.31E-02	5.08E-01	7.93E-02
S-TF-W	5.90E-01	7.44E-02	4.39E-01	7.23E-02
U-TF-SE	6.47E-01	7.50E-02	6.12E-01	8.37E-02
U-TF-W	7.52E-01	8.77E-02	5.87E-01	7.95E-02
U-TF-NE	5.10E-01	1.38E-01	4.31E-01	1.78E-01
2E N	8.38E-01	9.59E-02	6.92E-01	1.00E-01
2E NE	7.27E-01	8.47E-02	6.00E-01	8.36E-02
2E 1	6.29E-01	7.46E-02	4.60E-01	7.01E-02
2E 2	6.13E-01	7.50E-02	4.69E-01	7.60E-02
2E 3	6.61E-01	7.65E-02	5.28E-01	7.05E-02
2E SE	7.48E-01	8.57E-02	6.14E-01	8.48E-02
BX-TF-W	5.89E-01	7.79E-02	5.62E-01	9.21E-02
B-TF-NE	4.31E-01	1.43E-01	5.57E-01	2.14E-01
B-TF-SE	6.78E-01	7.95E-02	5.84E-01	8.19E-02
C-TF-NE	7.40E-01	9.95E-02	6.57E-01	1.17E-01
C-TF-SE	6.19E-01	1.18E-01	5.56E-01	1.39E-01
A-TF-W #1	6.41E-01	9.38E-02	5.96E-01	9.92E-02
A-TF-W #2	9.38E-01	1.08E-01	8.16E-01	1.06E-01
A-TF-E #1	4.82E-01	6.83E-02	5.01E-01	8.14E-02
A-TF-E #2	6.68E-01	7.96E-02	5.27E-01	7.55E-02
A-TF-E #3	7.07E-01	9.03E-02	5.00E-01	8.93E-02
A-TF-E #4	6.06E-01	7.17E-02	5.25E-01	7.54E-02

Note: Negetive values indicate concentrations at or near background levels of radioactivity.

Table E-6. Grid Site Vegetation Results for 200 West Area for 1989 (pCi/g dry weight). (sheet 1 of 6)

Location	Nuclide	Result	+/- Error
2W7	Be-7	1.19E+00	2.22E-01
2W7	Ce-141	-0.0156	2.01E-02
2W7	Co-60	-0.00297	1.61E-02
2W7	Cs-137	8.18E-01	9.07E-02
2W7	Eu-152	6.64E-02	7.30E-02
2W7	Eu-154	-0.0211	5.41E-02
2W7	Eu-155	1.75E-02	3.93E-02
2W7	I-129	-0.0184	3.05E-01
2W7	K-40	1.56E+01	1.70E+00
2W7	Nb-95	1.32E-02	1.92E-02
2W7	Pb-212	4.10E-01	5.13E-02
2W7	Pb-214	3.23E-01	5.27E-02
2W7	Pu-238	1.04E-03	4.40E-04
2W7	Pu-239	4.68E-03	9.89E-04
2W7	Sr-90	1.91E-01	4.04E-02
2W7	Tc-99	1.43E+00	1.26E+00
2W7	Zr-95	-0.0025	2.64E-02
2W8	Be-7	3.09E+00	1.24E+00
2W8	Ce-141	-0.0232	9.41E-02
2W8	Co-60	3.48E-02	1.10E-01
2W8	Cs-137	1.83E+00	3.19E-01
2W8	Eu-152	1.40E-01	1.99E-01
2W8	Eu-154	-0.0878	1.90E-01
2W8	Eu-155	1.19E-01	1.88E-01
2W8	I-129	-0.266	2.57E-01
2W8	K-40	1.05E+01	2.73E+00
2W8	Nb-95	7.32E-02	8.57E-02
2W8	Pb-212	9.26E-02	1.06E-01
2W8	Pb-214	1.03E-01	1.43E-01
2W8	Pu-238	3.93E-04	4.51E-04
2W8	Pu-239	7.43E-03	1.69E-03
2W8	Sr-90	6.80E-01	1.30E-01
2W8	Tc-99	9.82E-01	1.22E+00
2W8	Zr-95	6.23E-02	1.36E-01

Note: Negative values indicate concentrations at or near background levels of radioactivity.

Table E-6. Grid Site Vegetation Results for 200 West Area for 1989 (pCi/g dry weight). (sheet 2 of 6)

Location	Nuclide	Result	+/-	Error
2W9	Be-7	2.92E+00		3.95E-01
2W9	Ce-141	6.82E-03		2.25E-02
2W9	Co-60	7.22E-03		1.63E-02
2W9	Cs-137	5.03E-01		6.24E-02
2W9	Eu-152	-0.00629		6.68E-02
2W9	Eu-154	-0.00713		5.16E-02
2W9	Eu-155	1.67E-03		4.73E-02
2W9	I-129	-0.0459		2.51E-01
2W9	K-40	8.29E+00		1.02E+00
2W9	Nb-95	-0.0165		2.06E-02
2W9	Pb-212	2.30E-02		2.84E-02
2W9	Pb-214	3.83E-02		3.22E-02
2W9	Pu-238	3.06E-04		3.64E-04
2W9	Pu-239	4.09E-02		5.82E-03
2W9	Sr-90	1.09E+00		2.09E-01
2W9	Tc-99	1.14E+00		1.23E+00
2W9	Zr-95	-0.0309		2.88E-02
2W13	Be-7	1.78E+00		2.97E-01
2W13	Ce-141	-0.0249		2.50E-02
2W13	Co-60	1.60E-02		1.52E-02
2W13	Cs-137	9.14E-01		1.03E-01
2W13	Eu-152	5.10E-02		7.99E-02
2W13	Eu-154	-0.0117		5.72E-02
2W13	Eu-155	-0.0124		4.29E-02
2W13	I-129	-0.0184		2.35E-01
2W13	K-40	1.06E+01		1.27E+00
2W13	Nb-95	6.77E-04		2.29E-02
2W13	Pb-212	2.99E-02		2.77E-02
2W13	Pb-214	9.34E-02		3.44E-02
2W13	Pu-238	4.20E-04		3.18E-04
2W13	Pu-239	2.90E-03		9.01E-04
2W13	Sr-90	5.72E-01		1.12E-01
2W13	Tc-99	6.48E-01		1.19E+00
2W13	Zr-95	4.62E-03		3.30E-02

Table E-6. Grid Site Vegetation Results for 200 West Area for 1989 (pCi/g dry weight). (sheet 3 of 6)

Location	Nuclide	Result	+/- Error
2W14	Be-7	2.25E+00	3.33E-01
2W14	Ce-141	-0.00342	1.96E-02
2W14	Co-60	4.05E-03	1.88E-02
2W14	Cs-137	8.33E-02	2.45E-02
2W14	Eu-152	-0.0386	8.45E-02
2W14	Eu-154	5.88E-02	6.02E-02
2W14	Eu-155	3.87E-03	3.59E-02
2W14	I-129	-0.0194	2.99E-01
2W14	K-40	1.17E+01	1.39E+00
2W14	Nb-95	1.44E-03	1.98E-02
2W14	Pb-212	3.17E-03	2.64E-02
2W14	Pb-214	3.80E-02	2.78E-02
2W14	Pu-238	2.41E-04	2.38E-04
2W14	Pu-239	6.97E-03	1.16E-03
2W14	Sr-90	7.70E-02	1.72E-02
2W14	Tc-99	8.68E-01	1.21E+00
2W14	Zr-95	-0.011	3.19E-02
2W17	Be-7	2.13E+00	3.07E-01
2W17	Ce-141	-0.00642	1.99E-02
2W17	Co-60	-0.00464	1.54E-02
2W17	Cs-137	5.50E-02	1.61E-02
2W17	Eu-152	4.50E-02	5.35E-02
2W17	Eu-154	-0.0141	4.88E-02
2W17	Eu-155	2.85E-02	2.99E-02
2W17	I-129	-0.0387	3.08E-01
2W17	K-40	1.30E+01	1.45E+00
2W17	Nb-95	-0.00501	2.23E-02
2W17	Pb-212	5.94E-02	2.46E-02
2W17	Pb-214	7.17E-02	3.22E-02
2W17	Pu-238	8.07E-04	3.53E-04
2W17	Pu-239	2.39E-02	3.16E-03
2W17	Sr-90	3.08E-01	6.17E-02
2W17	Tc-99	1.47E+00	1.26E+00
2W17	Zr-95	6.13E-03	2.91E-02

Table E-6. Grid Site Vegetation Results for 200 West Area for 1989 (pCi/g dry weight). (sheet 4 of 6)

Location	Nuclide	Result	+/- Error
2W23	Be-7	1.75E+00	3.35E-01
2W23	Ce-141	9.33E-03	2.46E-02
2W23	Co-60	7.44E-03	1.75E-02
2W23	Cs-137	2.15E+00	2.26E-01
2W23	Eu-152	3.96E-02	8.77E-02
2W23	Eu-154	-0.0079	6.02E-02
2W23	Eu-155	3.90E-02	4.76E-02
2W23	I-129	8.27E-02	1.77E-01
2W23	K-40	1.54E+01	1.72E+00
2W23	Nb-95	-0.00683	2.32E-02
2W23	Pb-212	1.37E-02	3.16E-02
2W23	Pb-214	6.46E-02	4.05E-02
2W23	Pu-238	1.39E-03	4.81E-04
2W23	Pu-239	5.86E-02	6.93E-03
2W23	Sr-90	2.26E-01	4.59E-02
2W23	Tc-99	7.69E-01	1.10E+00
2W23	Zr-95	1.02E-02	3.28E-02
2W24	Be-7	2.20E+00	3.28E-01
2W24	Ce-141	-0.00738	2.38E-02
2W24	Co-60	5.86E-03	1.44E-02
2W24	Cs-137	1.85E-01	2.90E-02
2W24	Eu-152	-0.00368	6.87E-02
2W24	Eu-154	-0.0096	4.91E-02
2W24	Eu-155	-0.0105	3.31E-02
2W24	I-129	1.10E-01	1.52E-01
2W24	K-40	1.11E+01	1.28E+00
2W24	Nb-95	9.26E-03	2.21E-02
2W24	Pb-212	3.27E-02	2.46E-02
2W24	Pb-214	2.16E-02	2.77E-02
2W24	Pu-238	2.88E-04	1.88E-04
2W24	Pu-239	5.48E-03	9.32E-04
2W24	Sr-90	7.09E-02	1.50E-02
2W24	Tc-99	8.11E+00	1.80E+00
2W24	Zr-95	-0.0184	2.91E-02

Table E-6. Grid Site Vegetation Results for 200 West Area for 1989 (pCi/g dry weight). (sheet 5 of 6)

Location	Nuclide	Result	+/- Error
2W28	Be-7	1.84E+00	3.43E-01
2W28	Ce-141	7.79E-03	3.06E-02
2W28	Co-60	1.34E-02	1.95E-02
2W28	Cs-137	7.63E-01	8.91E-02
2W28	Eu-152	2.51E-02	9.19E-02
2W28	Eu-154	1.00E-02	5.96E-02
2W28	Eu-155	-0.0179	3.93E-02
2W28	I-129	7.81E-02	1.40E-01
2W28	K-40	1.16E+01	1.38E+00
2W28	Nb-95	-0.0171	2.99E-02
2W28	Pb-212	2.31E-02	3.07E-02
2W28	Pb-214	2.58E-02	3.01E-02
2W28	Pu-238	1.46E-04	1.50E-04
2W28	Pu-239	4.66E-03	8.09E-04
2W28	Sr-90	3.55E-01	6.91E-02
2W28	Tc-99	3.70E-01	1.07E+00
2W28	Zr-95	-0.0255	3.68E-02
2W30	Be-7	3.14E+00	4.34E-01
2W30	Ce-141	-0.00483	2.85E-02
2W30	Co-60	2.94E-02	2.00E-02
2W30	Cs-137	1.31E-01	3.10E-02
2W30	Eu-152	4.78E-02	7.29E-02
2W30	Eu-154	-0.0712	6.22E-02
2W30	Eu-155	-0.00306	4.05E-02
2W30	I-129	-0.286	2.43E-01
2W30	K-40	1.22E+01	1.41E+00
2W30	Nb-95	-0.0194	2.58E-02
2W30	Pb-212	5.07E-02	3.26E-02
2W30	Pb-214	3.85E-02	3.04E-02
2W30	Pu-238	4.69E-04	2.24E-04
2W30	Pu-239	9.78E-03	1.41E-03
2W30	Sr-90	7.60E-02	1.66E-02
2W30	Tc-99	1.48E+00	1.16E+00
2W30	Zr-95	2.42E-02	3.58E-02

Table E-6. Grid Site Vegetation Results for 200 West Area for 1989 (pCi/g dry weight). (sheet 6 of 6)

Location	Nuclide	Result	+/- Error
2W33	Be-7	1.89E+00	3.19E-01
2W33	Ce-141	-0.0158	2.57E-02
2W33	Co-60	-0.0124	1.72E-02
2W33	Cs-137	1.22E-01	2.57E-02
2W33	Eu-152	5.64E-02	7.43E-02
2W33	Eu-154	-0.0856	6.02E-02
2W33	Eu-155	-0.00213	3.78E-02
2W33	I-129	2.85E-01	3.06E-01
2W33	K-40	1.12E+01	1.28E+00
2W33	Nb-95	-0.00104	2.47E-02
2W33	Pb-212	1.15E-02	2.59E-02
2W33	Pb-214	4.47E-02	3.10E-02
2W33	Pu-238	5.53E-04	2.99E-04
2W33	Pu-239	1.64E-02	2.39E-03
2W33	Sr-90	7.83E-02	1.65E-02
2W33	Tc-99	4.17E-01	1.07E+00
2W33	Zr-95	0.00E+00	3.30E-02
2W34	Be-7	1.95E+00	3.18E-01
2W34	Ce-141	7.32E-04	2.75E-02
2W34	Co-60	-0.0154	1.86E-02
2W34	Cs-137	8.77E-02	2.36E-02
2W34	Eu-152	-0.0222	8.64E-02
2W34	Eu-154	4.74E-02	5.45E-02
2W34	Eu-155	1.45E-02	4.76E-02
2W34	I-129	0.00E+00	1.53E-01
2W34	K-40	1.51E+01	1.70E+00
2W34	Nb-95	-0.00538	2.44E-02
2W34	Pb-212	1.08E-01	3.51E-02
2W34	Pb-214	7.83E-02	4.04E-02
2W34	Pu-238	2.20E-02	2.81E-03
2W34	Pu-239	5.63E-03	1.02E-03
2W34	Sr-90	5.11E-01	1.01E-01
2W34	Tc-99	6.15E-01	1.09E+00
2W34	Zr-95	-0.0293	3.75E-02

Table E-7. Grid Site Vegetation Results for 200 West Area for 1989 (pCi/g dry weight).

Nuclide	MAXIMUM	MINIMUM	AVERAGE
Be-7	3.14E+00	1.19E+00	2.18E+00
Ce-141	9.33E-03	-2.49E-02	-6.41E-03
Co-60	3.48E-02	-1.54E-02	6.90E-03
Cs-137	2.15E+00	5.50E-02	6.37E-01
Eu-152	1.40E-01	-3.86E-02	3.34E-02
Eu-154	5.88E-02	-8.78E-02	-1.67E-02
Eu-155	1.19E-01	-1.79E-02	1.48E-02
I-129	2.85E-01	-2.86E-01	-1.14E-02
K-40	1.56E+01	8.29E+00	1.22E+01
Nb-95	7.32E-02	-1.94E-02	2.21E-03
Pb-212	4.10E-01	3.17E-03	7.15E-02
Pb-214	3.23E-01	2.16E-02	7.84E-02
Pu-238	2.20E-02	1.46E-04	2.34E-03
Pu-239	5.86E-02	2.90E-03	1.56E-02
Sr-90	1.09E+00	7.09E-02	3.53E-01
Tc-99	8.11E+00	3.70E-01	1.52E+00
Zr-95	6.23E-02	-3.09E-02	-8.46E-04

Table E-8. Grid Site Vegetation Results for 200 East Area for 1989 (pCi/g dry weight). (sheet 1 of 11)

Location	Nuclide	Result	+/- Error
2E3	Be-7	2.61E+00	3.61E-01
2E3	Ce-141	-0.0127	2.18E-02
2E3	Co-60	5.09E-02	2.25E-02
2E3	Cs-137	4.64E-01	5.86E-02
2E3	Eu-152	-0.00563	8.07E-02
2E3	Eu-154	3.80E-02	5.79E-02
2E3	Eu-155	-0.00908	4.17E-02
2E3	I-129	-0.229	3.22E-01
2E3	K-40	1.10E+01	1.30E+00
2E3	Nb-95	-0.0152	2.17E-02
2E3	Pb-212	4.25E-02	3.25E-02
2E3	Pb-214	5.33E-02	3.22E-02
2E3	Pu-238	1.22E-04	1.45E-04
2E3	Pu-239	7.26E-04	3.17E-04
2E3	Sr-90	2.48E-01	4.92E-02
2E3	Tc-99	6.07E-01	1.14E+00
2E3	Zr-95	-0.00063	3.02E-02
2E4	Be-7	3.62E+00	4.49E-01
2E4	Ce-141	8.20E-03	1.70E-02
2E4	Co-60	2.60E-03	1.63E-02
2E4	Cs-137	3.79E-01	4.89E-02
2E4	Eu-152	2.31E-02	6.70E-02
2E4	Eu-154	6.21E-02	4.79E-02
2E4	Eu-155	3.66E-04	3.74E-02
2E4	I-129	2.57E-01	1.40E-01
2E4	K-40	1.05E+01	1.21E+00
2E4	Nb-95	7.03E-03	1.61E-02
2E4	Pb-212	1.48E-02	2.45E-02
2E4	Pb-214	6.36E-02	3.02E-02
2E4	Pu-238	2.51E-04	2.22E-04
2E4	Pu-239	4.33E-04	3.32E-04
2E4	Sr-90	3.06E-01	5.96E-02
2E4	Tc-99	3.94E-01	1.12E+00
2E4	Zr-95	2.13E-02	2.62E-02

Table E-8. Grid Site Vegetation Results for 200 East Area for 1989 (pCi/g dry weight). (sheet 2 of 11)

Location	Nuclide	Result	+/- Error
2E8	Be-7	1.77E+00	2.51E-01
2E8	Ce-141	-0.0108	1.77E-02
2E8	Co-60	2.04E-02	1.40E-02
2E8	Cs-137	6.33E-02	1.97E-02
2E8	Eu-152	8.22E-03	6.13E-02
2E8	Eu-154	2.21E-03	4.44E-02
2E8	Eu-155	2.59E-02	3.00E-02
2E8	I-129	6.43E-02	2.28E-01
2E8	K-40	1.09E+01	1.26E+00
2E8	Nb-95	7.69E-03	1.78E-02
2E8	Pb-212	5.21E-02	1.80E-02
2E8	Pb-214	3.91E-02	2.69E-02
2E8	Pu-238	9.34E-05	1.04E-04
2E8	Pu-239	1.80E-03	5.01E-04
2E8	Sr-90	3.12E-02	7.86E-03
2E8	Tc-99	8.03E-02	1.10E+00
2E8	Zr-95	1.78E-03	2.60E-02
2E9	Be-7	2.83E+00	3.91E-01
2E9	Ce-141	8.19E-03	1.97E-02
2E9	Co-60	4.14E-03	1.98E-02
2E9	Cs-137	2.56E-01	3.89E-02
2E9	Eu-152	4.74E-02	9.25E-02
2E9	Eu-154	4.44E-02	5.78E-02
2E9	Eu-155	2.30E-02	3.79E-02
2E9	I-129	-0.0829	3.46E-01
2E9	K-40	1.34E+01	1.56E+00
2E9	Nb-95	-0.0066	2.15E-02
2E9	Pb-212	2.91E-02	3.18E-02
2E9	Pb-214	6.16E-02	3.21E-02
2E9	Pu-238	2.00E-04	1.61E-04
2E9	Pu-239	4.19E-03	8.59E-04
2E9	Sr-90	2.74E-01	5.15E-02
2E9	Tc-99	1.12E+00	1.18E+00
2E9	Zr-95	-0.00936	3.46E-02

Table E-8. Grid Site Vegetation Results for 200 East Area for 1989 (pCi/g dry weight). (sheet 3 of 11)

Location	Nuclide	Result	+/- Error
2E10	Be-7	2.09E+00	3.14E-01
2E10	Ce-141	-0.00318	2.32E-02
2E10	Co-60	8.54E-03	2.29E-02
2E10	Cs-137	3.74E-01	5.15E-02
2E10	Eu-152	4.15E-02	8.60E-02
2E10	Eu-154	-0.00825	6.28E-02
2E10	Eu-155	-0.0332	4.91E-02
2E10	I-129	3.77E-01	2.40E-01
2E10	K-40	1.28E+01	1.47E+00
2E10	Nb-95	-0.0018	2.06E-02
2E10	Pb-212	2.07E-02	3.07E-02
2E10	Pb-214	5.19E-02	3.49E-02
2E10	Pu-238	5.55E-04	2.90E-04
2E10	Pu-239	1.09E-03	4.32E-04
2E10	Sr-90	1.80E+00	3.61E-01
2E10	Tc-99	1.93E-01	1.10E+00
2E10	Zr-95	-0.00094	3.22E-02
2E12	Be-7	1.85E+00	3.19E-01
2E12	Ce-141	2.78E-03	2.65E-02
2E12	Co-60	2.45E-03	2.15E-02
2E12	Cs-137	2.27E-01	3.69E-02
2E12	Eu-152	-0.0468	8.90E-02
2E12	Eu-154	2.56E-02	6.14E-02
2E12	Eu-155	1.60E-02	5.72E-02
2E12	I-129	6.08E-02	3.19E-01
2E12	K-40	1.06E+01	1.30E+00
2E12	Nb-95	-0.00249	2.30E-02
2E12	Pb-212	2.78E-02	3.42E-02
2E12	Pb-214	4.11E-02	3.52E-02
2E12	Pu-238	3.03E-04	2.23E-04
2E12	Pu-239	1.08E-03	3.99E-04
2E12	Sr-90	1.06E-01	2.11E-02
2E12	Tc-99	7.38E-01	1.15E+00
2E12	Zr-95	-0.0106	3.73E-02

Table E-8. Grid Site Vegetation Results for 200 East Area for 1989 (pCi/g dry weight).
(sheet 4 of 11)

Location	Nuclide	Result	+/- Error
2E13	Be-7	3.02E+00	4.09E-01
2E13	Ce-141	-0.0125	2.02E-02
2E13	Co-60	3.58E-03	1.96E-02
2E13	Cs-137	9.90E-02	2.31E-02
2E13	Eu-152	2.52E-02	6.82E-02
2E13	Eu-154	8.52E-03	6.03E-02
2E13	Eu-155	-0.0107	4.19E-02
2E13	I-129	1.29E-01	1.69E-01
2E13	K-40	1.27E+01	1.46E+00
2E13	Nb-95	1.66E-02	2.05E-02
2E13	Pb-212	6.24E-02	3.29E-02
2E13	Pb-214	7.09E-02	3.08E-02
2E13	Pu-238	2.20E-03	6.71E-04
2E13	Pu-239	5.79E-03	1.19E-03
2E13	Sr-90	1.21E-01	2.42E-02
2E13	Tc-99	4.26E-01	1.12E+00
2E13	Zr-95	-0.00654	2.84E-02
2E14	Be-7	2.62E+00	3.52E-01
2E14	Ce-141	1.29E-03	2.12E-02
2E14	Co-60	5.46E-03	1.66E-02
2E14	Cs-137	1.16E-01	2.45E-02
2E14	Eu-152	1.13E-01	7.98E-02
2E14	Eu-154	1.25E-02	6.00E-02
2E14	Eu-155	-0.0168	4.66E-02
2E14	I-129	-0.0857	3.56E-01
2E14	K-40	1.41E+01	1.59E+00
2E14	Nb-95	-0.0129	2.04E-02
2E14	Pb-212	2.18E-02	2.73E-02
2E14	Pb-214	5.17E-02	3.02E-02
2E14	Pu-238	3.90E-05	1.21E-04
2E14	Pu-239	1.80E-03	5.46E-04
2E14	Sr-90	1.53E-01	3.16E-02
2E14	Tc-99	5.10E-02	1.09E+00
2E14	Zr-95	4.06E-03	2.98E-02

Table E-8. Grid Site Vegetation Results for 200 East Area for 1989 (pCi/g dry weight). (sheet 5 of 11)

Location	Nuclide	Result	+/- Error
2E17	Be-7	2.64E+00	3.71E-01
2E17	Ce-141	5.19E-03	2.06E-02
2E17	Co-60	1.27E-02	1.68E-02
2E17	Cs-137	3.07E-01	4.34E-02
2E17	Eu-152	6.96E-03	7.05E-02
2E17	Eu-154	3.41E-02	4.87E-02
2E17	Eu-155	4.03E-02	3.84E-02
2E17	I-129	-0.0551	2.67E-01
2E17	K-40	1.39E+01	1.57E+00
2E17	Nb-95	-0.0107	1.77E-02
2E17	Pb-212	7.77E-02	3.41E-02
2E17	Pb-214	8.68E-02	3.97E-02
2E17	Pu-238	5.85E-04	3.42E-04
2E17	Pu-239	3.38E-03	9.07E-04
2E17	Sr-90	5.81E+00	1.15E+00
2E17	Tc-99	8.15E-01	1.16E+00
2E17	Zr-95	-0.0147	3.06E-02
2E18	Be-7	2.63E+00	3.80E-01
2E18	Ce-141	-0.00682	2.15E-02
2E18	Co-60	1.08E-02	1.88E-02
2E18	Cs-137	4.73E-01	6.02E-02
2E18	Eu-152	-0.0127	8.80E-02
2E18	Eu-154	8.42E-03	6.78E-02
2E18	Eu-155	1.40E-02	4.50E-02
2E18	I-129	2.02E-01	2.30E-01
2E18	K-40	1.45E+01	1.64E+00
2E18	Nb-95	6.32E-03	2.17E-02
2E18	Pb-212	5.86E-02	3.03E-02
2E18	Pb-214	8.79E-02	3.47E-02
2E18	Pu-238	1.17E-04	1.31E-04
2E18	Pu-239	1.00E-03	4.06E-04
2E18	Sr-90	5.18E-01	1.04E-01
2E18	Tc-99	3.26E-01	1.12E+00
2E18	Zr-95	-0.00472	2.94E-02

Table E-8. Grid Site Vegetation Results for 200 East Area for 1989 (pCi/g dry weight). (sheet 6 of 11)

Location	Nuclide	Result	+/- Error
2E20	Be-7	2.10E+00	3.56E-01
2E20	Ce-141	-0.0163	2.76E-02
2E20	Co-60	-0.00436	1.95E-02
2E20	Cs-137	1.67E-01	3.11E-02
2E20	Eu-152	2.70E-02	7.84E-02
2E20	Eu-154	1.85E-02	6.11E-02
2E20	Eu-155	-0.00461	5.07E-02
2E20	I-129	3.21E-01	2.30E-01
2E20	K-40	1.04E+01	1.24E+00
2E20	Nb-95	-0.00084	2.63E-02
2E20	Pb-212	1.10E-01	3.78E-02
2E20	Pb-214	6.68E-02	3.26E-02
2E20	Pu-238	1.47E-04	1.44E-04
2E20	Pu-239	3.17E-03	7.56E-04
2E20	Sr-90	2.41E-01	4.87E-02
2E20	Tc-99	9.33E-01	1.22E+00
2E20	Zr-95	-0.013	3.76E-02
2E24	Be-7	3.23E+00	4.34E-01
2E24	Ce-141	-0.0192	2.87E-02
2E24	Co-60	2.41E-02	1.84E-02
2E24	Cs-137	1.09E+00	1.21E-01
2E24	Eu-152	-0.0786	1.01E-01
2E24	Eu-154	2.29E-02	5.96E-02
2E24	Eu-155	8.13E-04	6.03E-02
2E24	I-129	2.48E-01	2.91E-01
2E24	K-40	1.30E+01	1.49E+00
2E24	Nb-95	-0.00473	2.18E-02
2E24	Pb-212	5.13E-02	3.59E-02
2E24	Pb-214	9.76E-02	4.52E-02
2E24	Pu-238	8.90E-04	5.04E-04
2E24	Pu-239	8.09E-03	1.80E-03
2E24	Ru-106	4.42E+00	5.42E-01
2E24	Sr-90	7.79E-01	1.49E-01
2E24	Tc-99	1.48E+00	1.26E+00
2E24	Zr-95	-0.0168	3.27E-02

Table E-8. Grid Site Vegetation Results for 200 East Area for 1989 (pCi/g dry weight). (sheet 7 of 11)

Location	Nuclide	Result	+/- Error
2E29	Be-7	2.01E+00	3.33E-01
2E29	Ce-141	-0.0207	2.37E-02
2E29	Co-60	8.53E-03	1.87E-02
2E29	Cs-137	4.52E-02	2.26E-02
2E29	Eu-152	-0.0829	9.26E-02
2E29	Eu-154	-0.0253	5.36E-02
2E29	Eu-155	3.59E-03	3.70E-02
2E29	I-129	0.00E+00	1.94E-01
2E29	K-40	1.49E+01	1.71E+00
2E29	Nb-95	1.42E-03	2.12E-02
2E29	Pb-212	1.98E-02	2.96E-02
2E29	Pb-214	3.28E-02	2.96E-02
2E29	Pu-238	9.47E-05	1.35E-04
2E29	Pu-239	9.24E-04	3.50E-04
2E29	Sr-90	1.10E-01	2.20E-02
2E29	Tc-99	1.11E+00	1.23E+00
2E29	Zr-95	1.16E-02	3.25E-02
2E30	Be-7	1.50E+00	2.50E-01
2E30	Ce-141	-0.0149	1.94E-02
2E30	Co-60	1.87E-03	1.44E-02
2E30	Cs-137	7.68E-02	2.31E-02
2E30	Eu-152	-0.0489	7.49E-02
2E30	Eu-154	-0.0238	4.71E-02
2E30	Eu-155	1.97E-02	3.19E-02
2E30	I-129	7.35E-02	2.49E-01
2E30	K-40	1.09E+01	1.25E+00
2E30	Nb-95	-0.0201	1.96E-02
2E30	Pb-212	7.60E-02	3.18E-02
2E30	Pb-214	7.13E-02	2.78E-02
2E30	Pu-238	5.30E-04	3.70E-04
2E30	Pu-239	4.67E-03	1.15E-03
2E30	Ru-106	6.62E-01	1.75E-01
2E30	Sr-90	5.69E-01	1.06E-01
2E30	Tc-99	5.78E-01	1.19E+00
2E30	Zr-95	5.86E-03	2.69E-02

Table E-8. Grid Site Vegetation Results for 200 East Area for 1989 (pCi/g dry weight). (sheet 8 of 11)

Location	Nuclide	Result	+/- Error
2EC	Be-7	1.99E+00	3.22E-01
2EC	Ce-141	-0.0133	2.62E-02
2EC	Co-60	-0.00348	1.50E-02
2EC	Cs-137	2.15E-01	3.56E-02
2EC	Eu-152	3.11E-02	8.23E-02
2EC	Eu-154	1.40E-02	5.19E-02
2EC	Eu-155	-0.00791	3.66E-02
2EC	I-129	2.97E-01	2.33E-01
2EC	K-40	1.28E+01	1.46E+00
2EC	Nb-95	1.10E-02	2.45E-02
2EC	Pb-212	1.06E-01	3.47E-02
2EC	Pb-214	4.48E-02	3.50E-02
2EC	Pu-238	4.23E-06	9.14E-05
2EC	Pu-239	5.42E-03	9.87E-04
2EC	Ru-106	5.03E-01	1.96E-01
2EC	Sr-90	1.74E-01	3.57E-02
2EC	Tc-99	6.75E-01	1.09E+00
2EC	Zr-95	3.93E-02	3.56E-02
2EDC	Be-7	2.98E+00	4.80E-01
2EDC	Ce-141	-0.0225	3.41E-02
2EDC	Co-60	6.69E-03	2.04E-02
2EDC	Cs-137	4.27E+00	4.37E-01
2EDC	Eu-152	6.64E-02	7.72E-02
2EDC	Eu-154	6.04E-02	5.72E-02
2EDC	Eu-155	2.10E-02	5.15E-02
2EDC	I-129	-0.058	2.86E-01
2EDC	K-40	1.32E+01	1.49E+00
2EDC	Nb-95	7.19E-03	2.58E-02
2EDC	Pb-212	1.06E-01	3.57E-02
2EDC	Pb-214	9.76E-02	4.39E-02
2EDC	Pu-238	4.83E-04	2.94E-04
2EDC	Pu-239	1.60E-02	2.43E-03
2EDC	Ru-106	5.09E-01	1.80E-01
2EDC	Sr-90	4.19E-01	8.42E-02
2EDC	Tc-99	7.47E-01	1.10E+00
2EDC	Zr-95	2.16E-02	3.53E-02

Table E-8. Grid Site Vegetation Results for 200 East Area for 1989 (pCi/g dry weight). (sheet 9 of 11)

Location	Nuclide	Result	+/- Error
GRT1	Be-7	3.00E+00	4.75E-01
GRT1	Ce-141	-0.0193	4.76E-02
GRT1	Co-60	0.00E+00	2.24E-02
GRT1	Cs-137	1.03E+00	1.19E-01
GRT1	Eu-152	8.00E-02	9.64E-02
GRT1	Eu-154	7.66E-03	7.02E-02
GRT1	Eu-155	-0.0064	5.45E-02
GRT1	I-129	-0.123	2.79E-01
GRT1	K-40	1.18E+01	1.46E+00
GRT1	Nb-95	-0.0151	3.07E-02
GRT1	Pb-212	9.51E-02	3.75E-02
GRT1	Pb-214	3.71E-02	4.51E-02
GRT1	Pu-238	1.59E-04	1.82E-04
GRT1	Pu-239	7.04E-03	1.24E-03
GRT1	Ru-106	5.97E-01	2.70E-01
GRT1	Sr-90	4.56E-01	8.47E-02
GRT1	Tc-99	5.59E-01	1.08E+00
GRT1	Zr-95	4.70E-03	4.51E-02
GRT2	Be-7	2.61E+00	4.09E-01
GRT2	Ce-141	-0.00405	3.18E-02
GRT2	Co-60	-0.0191	1.97E-02
GRT2	Cs-137	2.03E+00	2.15E-01
GRT2	Eu-152	3.94E-02	8.52E-02
GRT2	Eu-154	-0.0152	6.52E-02
GRT2	Eu-155	-0.0106	4.78E-02
GRT2	I-129	-0.249	2.75E-01
GRT2	K-40	1.30E+01	1.48E+00
GRT2	Nb-95	3.09E-03	2.68E-02
GRT2	Pb-212	1.05E-01	3.59E-02
GRT2	Pb-214	1.37E-01	4.24E-02
GRT2	Pu-238	4.45E-04	3.09E-04
GRT2	Pu-239	6.36E-03	1.29E-03
GRT2	Ru-106	2.85E-01	1.37E-01
GRT2	Sr-90	2.75E-01	5.25E-02
GRT2	Tc-99	5.49E-01	1.08E+00
GRT2	Zr-95	1.70E-02	3.59E-02

Table E-8. Grid Site Vegetation Results for 200 East Area for 1989 (pCi/g dry weight). (sheet 10 of 11)

Location	Nuclide	Result	+/- Error
GRT4	Be-7	3.22E+00	4.44E-01
GRT4	Ce-141	1.61E-02	3.17E-02
GRT4	Co-60	6.96E-03	1.95E-02
GRT4	Cs-137	4.11E-01	5.21E-02
GRT4	Eu-152	6.38E-02	8.01E-02
GRT4	Eu-154	-0.00542	6.01E-02
GRT4	Eu-155	3.29E-02	5.02E-02
GRT4	I-129	-0.00459	1.75E-01
GRT4	K-40	1.17E+01	1.34E+00
GRT4	Nb-95	-0.0178	2.57E-02
GRT4	Pb-212	7.78E-02	2.91E-02
GRT4	Pb-214	1.15E-01	3.76E-02
GRT4	Pu-238	4.74E-04	2.99E-04
GRT4	Pu-239	7.74E-03	1.42E-03
GRT4	Ru-106	2.17E+00	3.19E-01
GRT4	Sr-90	1.87E-01	3.82E-02
GRT4	Tc-99	6.03E-01	1.09E+00
GRT4	Zr-95	1.80E-02	3.48E-02
GRT5	Be-7	2.82E+00	4.53E-01
GRT5	Ce-141	7.36E-03	4.07E-02
GRT5	Co-60	-0.0177	2.23E-02
GRT5	Cs-137	2.04E-01	3.82E-02
GRT5	Eu-152	-0.013	1.02E-01
GRT5	Eu-154	-0.0251	6.20E-02
GRT5	Eu-155	-0.0603	6.44E-02
GRT5	I-129	6.63E-02	2.33E-01
GRT5	K-40	1.29E+01	1.55E+00
GRT5	Nb-95	4.98E-03	2.93E-02
GRT5	Pb-212	6.58E-02	3.42E-02
GRT5	Pb-214	5.77E-02	3.69E-02
GRT5	Pu-238	4.69E-04	2.84E-04
GRT5	Pu-239	2.42E-03	6.87E-04
GRT5	Sr-90	4.12E-01	7.91E-02
GRT5	Tc-99	1.74E+00	1.18E+00
GRT5	Zr-95	-0.00231	4.01E-02

Table E-8. Grid Site Vegetation Results for 200 East Area for 1989 (pCi/g dry weight). (sheet 11 of 11)

Location	Nuclide	Result	+/- Error
GRT6	Be-7	2.09E+00	3.56E-01
GRT6	Ce-141	4.61E-03	2.99E-02
GRT6	Co-60	4.45E-03	1.86E-02
GRT6	Cs-137	4.10E-01	5.69E-02
GRT6	Eu-152	9.45E-02	8.75E-02
GRT6	Eu-154	-0.0345	6.40E-02
GRT6	Eu-155	-0.00763	4.07E-02
GRT6	I-129	1.79E-01	1.68E-01
GRT6	K-40	1.10E+01	1.35E+00
GRT6	Nb-95	-0.0192	2.85E-02
GRT6	Pb-212	5.95E-02	3.52E-02
GRT6	Pb-214	7.84E-02	4.78E-02
GRT6	Pu-238	1.75E-04	1.72E-04
GRT6	Pu-239	6.95E-03	1.33E-03
GRT6	Ru-106	3.37E-01	1.85E-01
GRT6	Sr-90	5.04E-01	1.02E-01
GRT6	Tc-99	8.97E-01	1.11E+00
GRT6	Zr-95	-0.0154	3.79E-02

Table E-9. Grid Site Vegetation Results for 200 East Area for 1989 (pCi/g dry weight).

Nuclide	MAXIMUM	MINIMUM	AVERAGE
Be-7	3.62E+00	1.50E+00	2.53E+00
Ce-141	1.61E-02	-0.0225	-0.00583
Co-60	5.09E-02	-0.0191	6.17E-03
Cs-137	4.27E+00	4.52E-02	6.05E-01
Eu-152	1.13E-01	-0.0829	1.81E-02
Eu-154	6.21E-02	-0.0345	1.06E-02
Eu-155	4.03E-02	-0.0603	1.44E-03
I-129	3.77E-01	-0.249	6.61E-02
K-40	1.49E+01	1.04E+01	1.24E+01
Nb-95	1.66E-02	-0.0201	-0.00295
Pb-212	1.10E-01	1.48E-02	6.09E-02
Pb-214	1.37E-01	3.28E-02	6.88E-02
Pu-238	2.20E-03	4.23E-06	3.97E-04
Pu-239	1.60E-02	4.33E-04	4.29E-03
Ru-106	4.42E+00	2.85E-01	1.19E+00
Sr-90	5.81E+00	3.12E-02	6.43E-01
Tc-99	1.74E+00	5.10E-02	6.96E-01
Zr-95	3.93E-02	-0.0168	2.39E-03

Note: Negative values indicate concentrations at or near background levels of radioactivity.

Figure E-10. Yearly Averages for Cesium-137 in Vegetation.

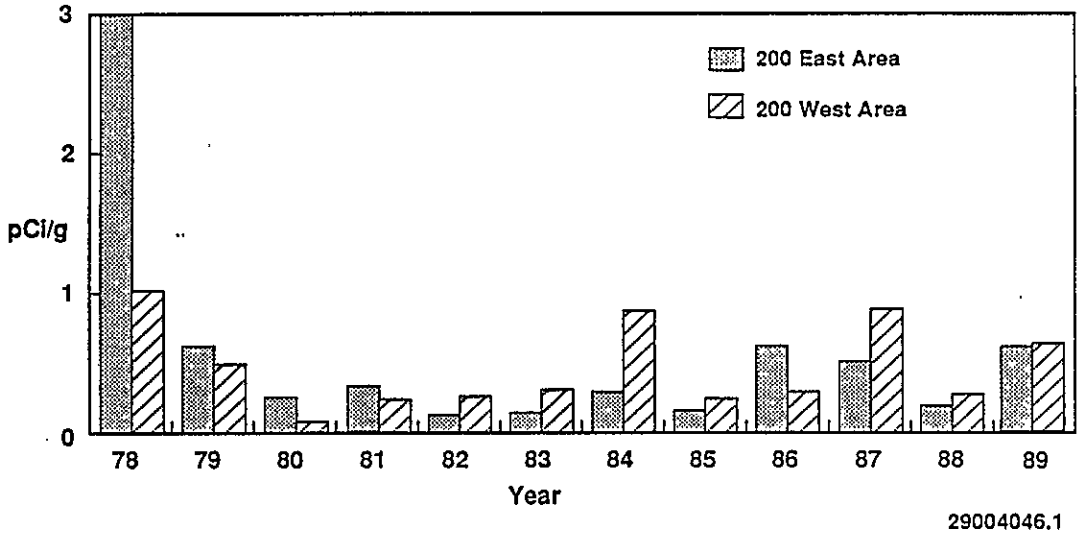


Table E-10. Location of Soil Samples Taken for Herbicide Residue.

216-T-35	216-B-5
216-T-14-17	218-E-4
216-T-4-1	216-B-35-42
218-W-2A	216-B-57
216-T-26-28 15.	216-B-56
216-Z-19-1-11	216-B-9
216-S-4	218-E-8
216-S-22	216-A-9
216-S-12	216-A-4
241-U-361	218-E-1

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APPENDIX F

EXTERNAL RADIATION MONITORING FIGURES AND TABLES

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Table F-1. Thermoluminescent Dosimeter Results (1989)
Yearly Dose Rate (mrem/yr). (sheet 1 of 2)

Map Location	Site	Max (a)	Min (a)	Total
2E 8	E-10E	124	80	104
2E 9	241-BX S	140	92	126
2E 11	E-12B N	128	92	114
2E 14	B-PLANT W	112	104	106
2E 15	B-PLANT NE	120	108	113
2E 17	241-C W	140	104	119
2E 20	B-PLANT SSW	104	80	96
2E 21	B-PLANT SSE	116	68	98
2E 33	200 EAST S	108	72	93
2E 36	200 EAST SW	124	72	96
2E D	216-A-29 E	120	100	111
GROUT NE N991	NE OF TGF	116	68	96
GROUT SE N992	SE OF TGF	112	72	98
GROUT SW N993	SW OF TGF	112	72	96
2W 6	200 WEST W	104	60	86
2W 7	W-2A E	120	60	99
2W 13	241-TX E	160	96	133
2W 23	241-U E	232	124	194
2W 24	U-PLANT SE	128	68	100
2W 28	241-SX E	136	76	116
A-25 POND N	GABLE MT. N	108	80	99
A-25 POND S	GABLE MT. S	104	64	89
A-29 DITCH	216-A-29	124	84	105
B-3 DITCH	216-B-3	180	116	144
B-63 DITCH	216-B-63	148	116	128
S-19 POND	216-S-19	112	44	82
U-10 POND	216-U-10	112	72	99
U-14 DITCH	216-U-14	108	15	90
WEST LAKE	WEST LAKE	100	64	85
Z-19 DITCH	216-Z-19	152	96	118
202A #1	PUREX #1	120	88	106
202A #2	PUREX #2	124	76	103
202A #3	PUREX #3	128	76	105
A10 #1	216-A-10 #1	136	88	112
A10 #2	216-A-10 #2	108	88	101
A30 #1	216-A-30 #1	116	76	100
A30 #2	216-A-30 #2	128	84	105
A36 B#1	216-A-36 #1	132	76	110
A36 B#2	216-A-36 #2	128	96	112
A37-1 #1	216-A-37 #1	116	84	100
A37-1 #2	216-A-37 #2	128	88	111

(a) Quarterly dose normilized to annual dose rate.

Table F-1. Thermoluminescent Dosimeter Results (1989)
Yearly Dose Rate (mrem/yr). (sheet 2 of 2)

Map Location	Site	Max (a)	Min (a)	Total
A-8 #1	216-A-8 #1	124	84	110
A-8 #2	216-A-8 #2	196	72	134
ATF #1	241-A	348	200	273
ATF #2	241-A	1812	136	562
ATF #3	241-A	2840	116	1158
ATF #4	241-A	9636	112	2545
ATF #5	241-A	140	108	125
ATF #6	241-A	164	100	125
ATF #7	241-A	196	108	151
ATF #8	241-A	3832	1660	2519
ATF #9	241-A	844	652	740
ATF #10	241-A	1316	848	998
ATF #11	241-A	152	108	136
ATF #12	241-A	140	108	131
ATF #13	241-A	240	124	165
B-55 #1	216-B-55 #1	132	88	116
B-55 #2	216-B-55 #2	120	92	111
B-62 #1	216-B-62 #1	148	104	117
B-62 #2	216-B-62 #2	140	80	109
U-12 #1	216-U-12 #1	116	92	109
U-12 #2	216-U-12 #2	132	100	121

(a) Quarterly dose normilized to annual dose rate.

Figure F-1. The PUREX Plant-Related Thermoluminescent Dosimeter Locations.

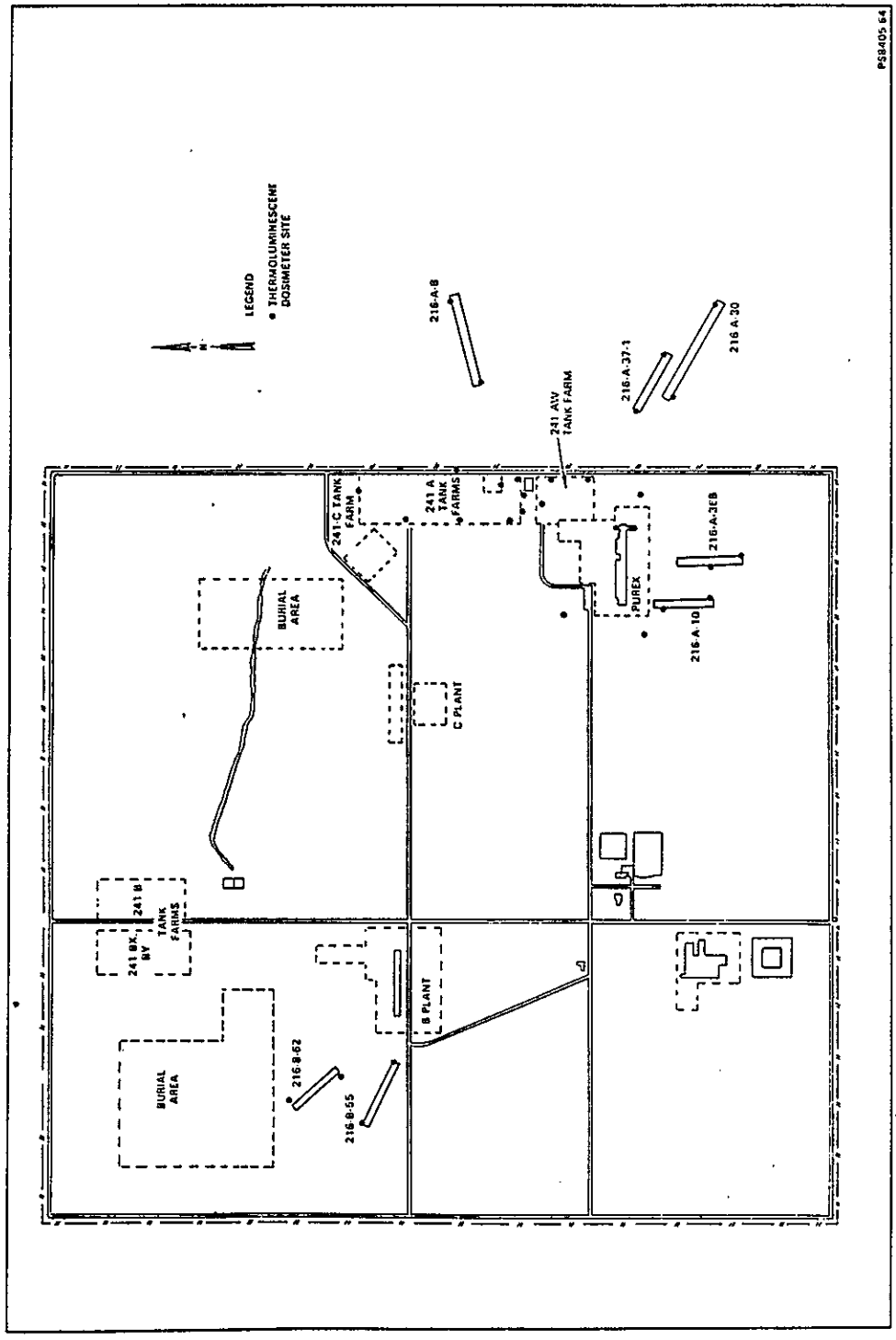
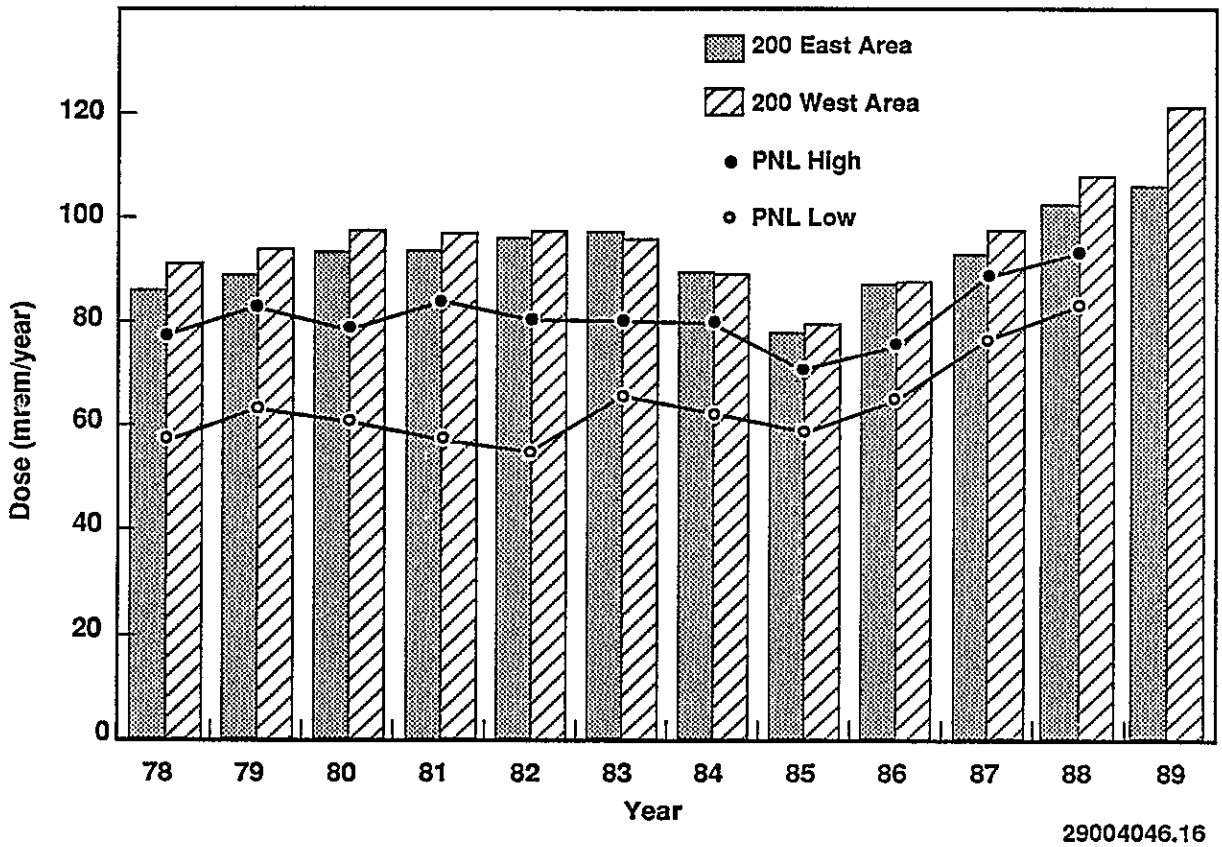


Figure F-2. Yearly Averages for Thermoluminescent Dosimeter Versus Pacific Northwest Laboratories Perimeter Stations.



APPENDIX G

POND AND DITCH MONITORING FIGURES AND TABLES

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Figure G-1. The 200 East Area Pond and Ditch Sample Sites.

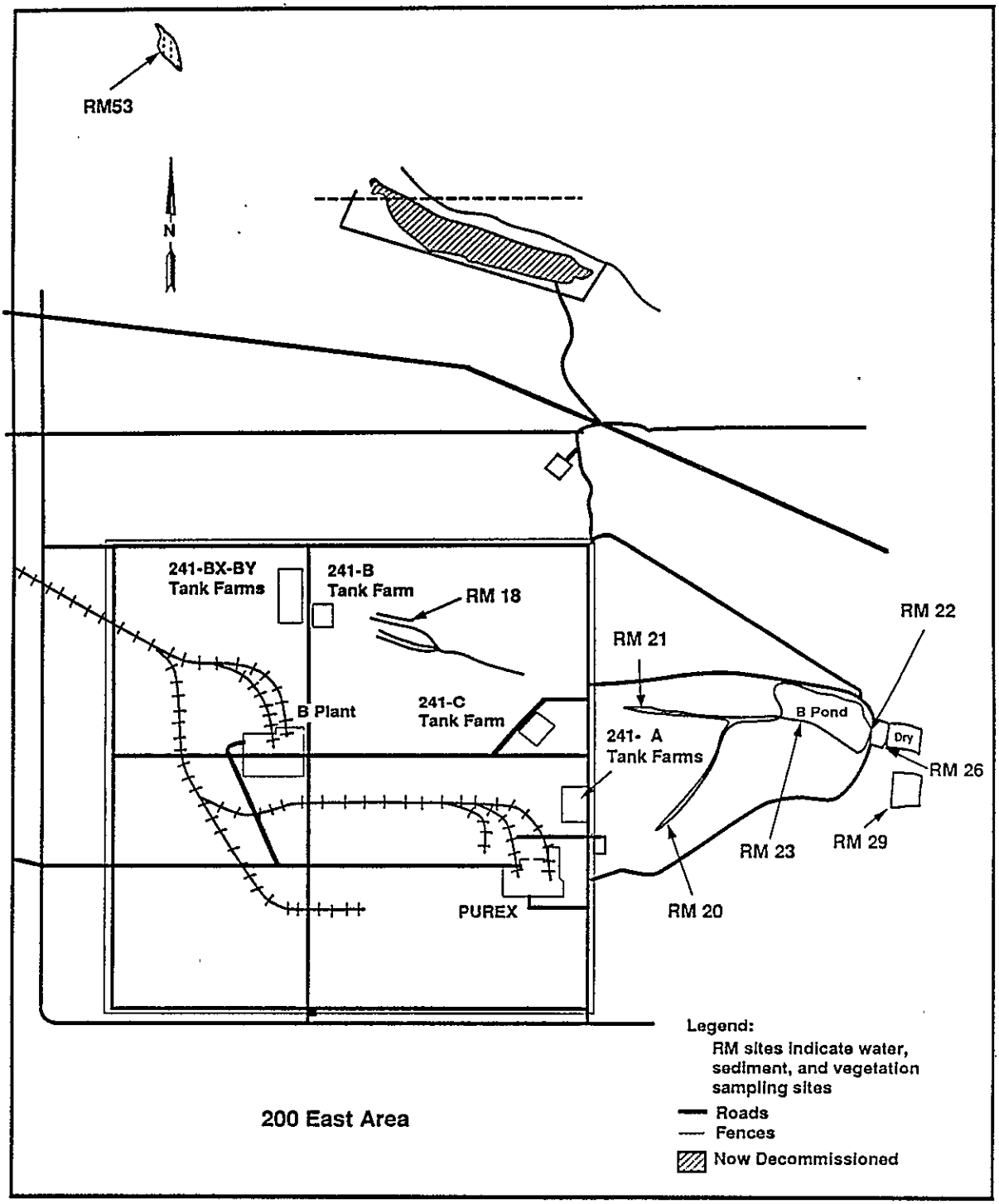

Figure G-2. The 200 West Area Pond and Ditch Sample Sites.

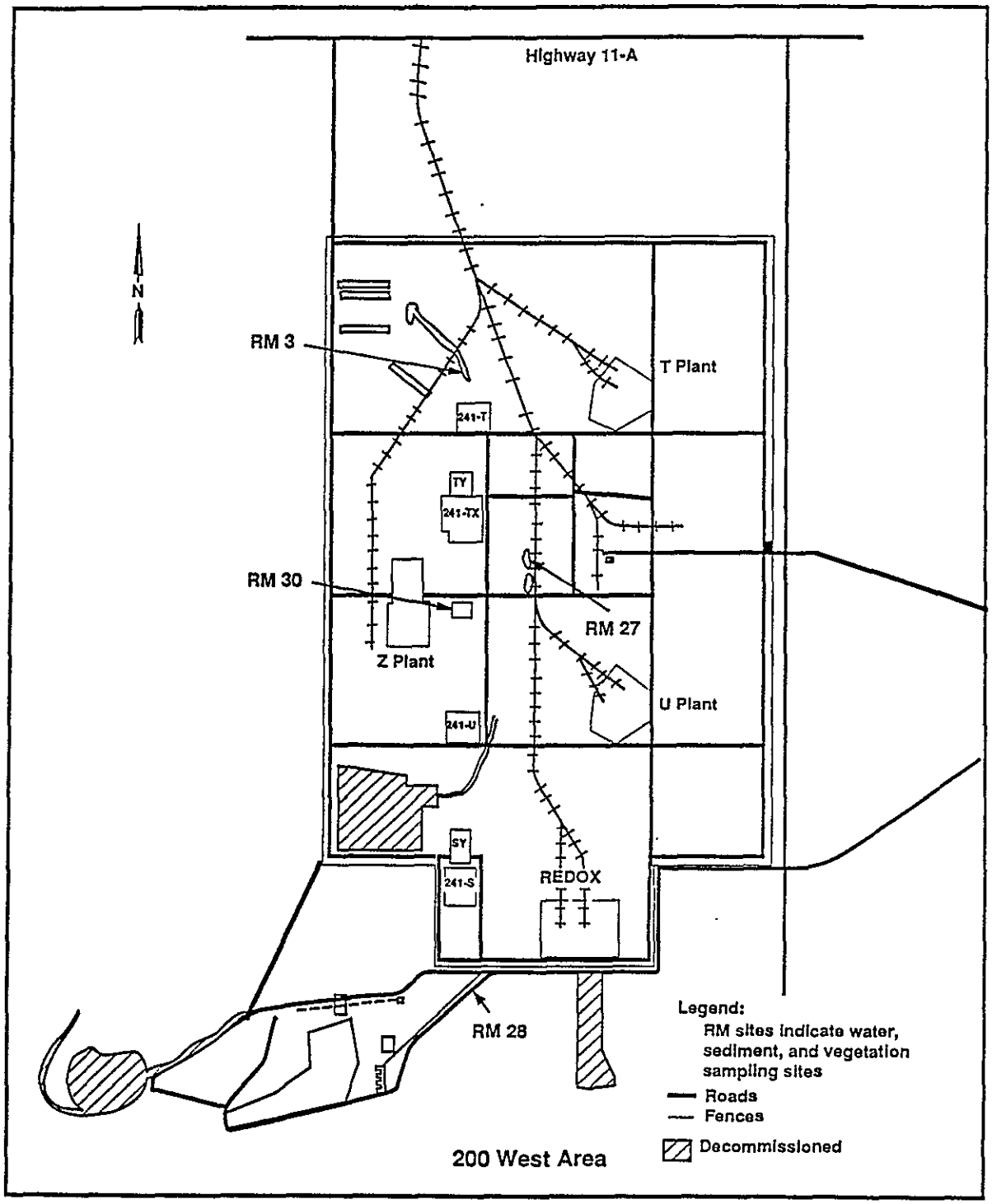

Table G-1. Water Samples.

ID NUMBER	LOCATION
RM3	T-4 Ditch
RM18	216-B-63 Ditch
RM20	216-A-29 Ditch
RM21	216-B-3-3 Ditch
RM22	216-B-3 Pond East
RM23	216-B-23 Pond South
RM26	216-B-3 Pond Overflow
RM27	West Powerhouse Pond
RM28	216-S-10 Ditch
RM29	216-B-3 3rd Overflow
RM30	216-Z-21 Basin
RM53	West Lake

Table G-2. Radiological Parameters in Water (1989) (pCi/L).

Site Number	Sampling Site	Total Beta		Total Alpha		Cs-137		Sr-90	
		Max	Min	Max	Min	Max	Min	Max	Min
RM 3	216-T-4-2 Ditch	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
RM 18	216-B-63 Ditch	66	<DL	7	<DL	107	<DL	28	<DL
RM 20	216-A-29 Ditch	<DL	<DL	<DL	<DL	62	<DL	<DL	<DL
RM 21	216-B-3-3 Ditch	225	<DL	38	<DL	64	<DL	26	<DL
RM 22	216-B-3 Pond North	115	<DL	27	<DL	90	<DL	<DL	<DL
RM 23	216-B-3 Pond South	232	<DL	<DL	<DL	64	<DL	29	<DL
RM 26	216-B-3 Pond Overflow	82	<DL	20	<DL	64	<DL	27	<DL
RM 27	Powerhouse Pond	7	<DL	<DL	<DL	63	<DL	23	<DL
RM 28	216-S-10 Ditch	<DL	<DL	<DL	<DL	112	<DL	<DL	<DL
RM 29	216-B-3 Pond 3rd Overflow	114	<DL	24	<DL	63	<DL	78	<DL
RM 30	216-Z-21 Basin	18	<DL	<DL	<DL	145	<DL	<DL	<DL
RM 53	Westlake	494	<DL	100	<DL	60	<DL	<DL	<DL
Detection Limit		100		40		200		100	
DCG		1,000(a)		30(b)		3,000		1,000	

NOTE: <DL = less than detection limit
(a) Using Sr-90 DCG for comparison.
(b) Using Pu-239 DCG for comparison.

Table G-3. Nonradiological Parameters in Water (1989).

Site Number	Sampling Site	pH			Nitrate(NO3)(ppm)		
		Max	Min	Ave	Max	Min	Ave
RM 3	216-T-4-2 Ditch	8.8	6.9	7.8	<DL	<DL	<DL
RM 18	216-B-63 Ditch	9.9	7.0	7.9	<DL	<DL	<DL
RM 20	216-A-29 Ditch	9.1	7.1	7.9	<DL	<DL	<DL
RM 21	216-B-3-3 Ditch	8.5	7.6	8.0	<DL	<DL	<DL
RM 22	216-B-3 Pond North	9.3	7.9	8.6	<DL	<DL	<DL
RM 23	216-B-3 Pond South	9.2	7.9	8.5	<DL	<DL	<DL
RM 26	216-B-3 Pond Overflow	9.5	7.9	8.7	<DL	<DL	<DL
RM 27	Powerhouse Pond	10.6	7.9	9.3	<DL	<DL	<DL
RM 28	216-S-10 Ditch	8.7	7.6	7.9	<DL	<DL	<DL
RM 29	216-B-3 Pond 3rd Overflow	9.9	7.9	8.7	<DL	<DL	<DL
RM 30	216-Z-21 Basin	9.6	7.6	8.3	<DL	<DL	<DL
RM 53	Westlake	10.3	9.2	9.5	<DL	<DL	<DL

NOTE: pH maximum and minimum are from weekly samples.
<DL = less than detection limit (1.2ppm)

Table G-4. Radionuclide Concentrations in Aquatic Vegetation Samples From Ponds and Ditches (1989).

Site Name	Sr-90 (pCi/g)	Ru-106 (pCi/g)	Sb-125 (pCi/g)	Cs-134 (pCi/g)	Cs-137 (pCi/g)	Ce-144 (pCi/g)	Tl-208 (pCi/g)	Pb-212 (pCi/g)	Bi-214 (pCi/g)	Pb-214 (pCi/g)	Pu-239 (pCi/g)	U (g/g)
216-A-29 Ditch	0.5	a	a	a	0.9	a	a	a	a	a	0.3	2.83E-7
216-B-3 3rd Overflow	0.4	a	a	a	3.12	a	a	a	a	a	<1	3.13E-7
216-B-3 Pond North	1.0	a	a	a	2.2	a	a	a	a	a	0.4	2.09E-7
216-B-3 Pond South	1.2	a	a	a	3.2	a	a	a	a	a	<1	8.84E-8
216-B-63 Ditch	3.9	a	a	a	2.3	a	a	a	a	a	<1	3.07E-8
216-S-10 Ditch	0.3	a	a	a	<0.3	a	a	a	a	a	<1	8.50E-8
216-T-4 Ditch	1.0	a	a	a	2.6	a	a	a	a	a	0.4	8.18E-9
West Lake	0.5	a	a	a	<0.3	a	a	a	a	a	<1	1.17E-7
216-Z-21 Basin	0.4	a	a	a	<0.3	a	a	a	a	a	.3	7.18E-8

(a) Not Routinely Sampled

Table G-5. Radionuclide Concentration in Sediment Samples From Ponds and Ditches (1989).

Site Name	Co-60 (pCi/g)	Sr-90 (pCi/g)	Ru-106 (pCi/g)	Sb-125 (pCi/g)	Cs-134 (pCi/g)	Cs-137 (pCi/g)	Ce-144 (pCi/g)	Tl-208 (pCi/g)	Pb-212 (pCi/g)	Bi-214 (pCi/g)	Pb-214 (pCi/g)	Ra-226 (pCi/g)	Pu-239 (pCi/g)	U(g/g)
216-A-29 Ditch	a	0.7	3.14	3.5	0.4	1.74	a	a	a	a	a	a	4.7	1.08E-6
216-B-3 Pond South	a	0.8	a	a	a	2.3	a	a	a	a	a	a	0.9	6.74E-7
216-B-3 Pond North	a	0.8	a	a	a	1.2	a	a	a	a	a	a	0.6	8.37E-7
216-B-3 Pond 1st Overflow	a	0.6	a	a	a	9.5	a	a	a	a	a	a	0.5	1.01E-6
216-B-3 Pond 3rd Overflow	a	0.7	a	a	a	2.4	a	a	a	a	a	a	1.6	7.94E-7
216-B-3-3 Ditch	a	0.8	a	a	0.5	1.3	6.0	a	a	a	a	a	2.6	3.95E-7
216-B-63 Ditch	a	6.4	a	a	a	4.0	a	a	a	a	a	a	<1	9.71E-6
216-Z-21 Basin	a	0.5	a	a	a	0.1	a	a	a	a	a	a	0.4	3.88E-7
216-S-10 Ditch	a	0.6	a	a	a	2.3	a	a	a	a	a	a	0.9	4.81E-7
216-T-4 Ditch	2.3	4.26	a	a	a	1660	a	a	a	a	a	a	1.3	9.67E-7
West Lake	a	0.8	a	a	a	0.2	a	a	a	a	a	a	<1	3.30E-7
200 Area Soil Standards	5,000	600	15	60,000	10,000	20,000	1,900	a	a	a	a	60	75	

(a) Not Routinely Sampled

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APPENDIX H

RADIOLOGICAL SURVEYS FIGURES AND TABLES

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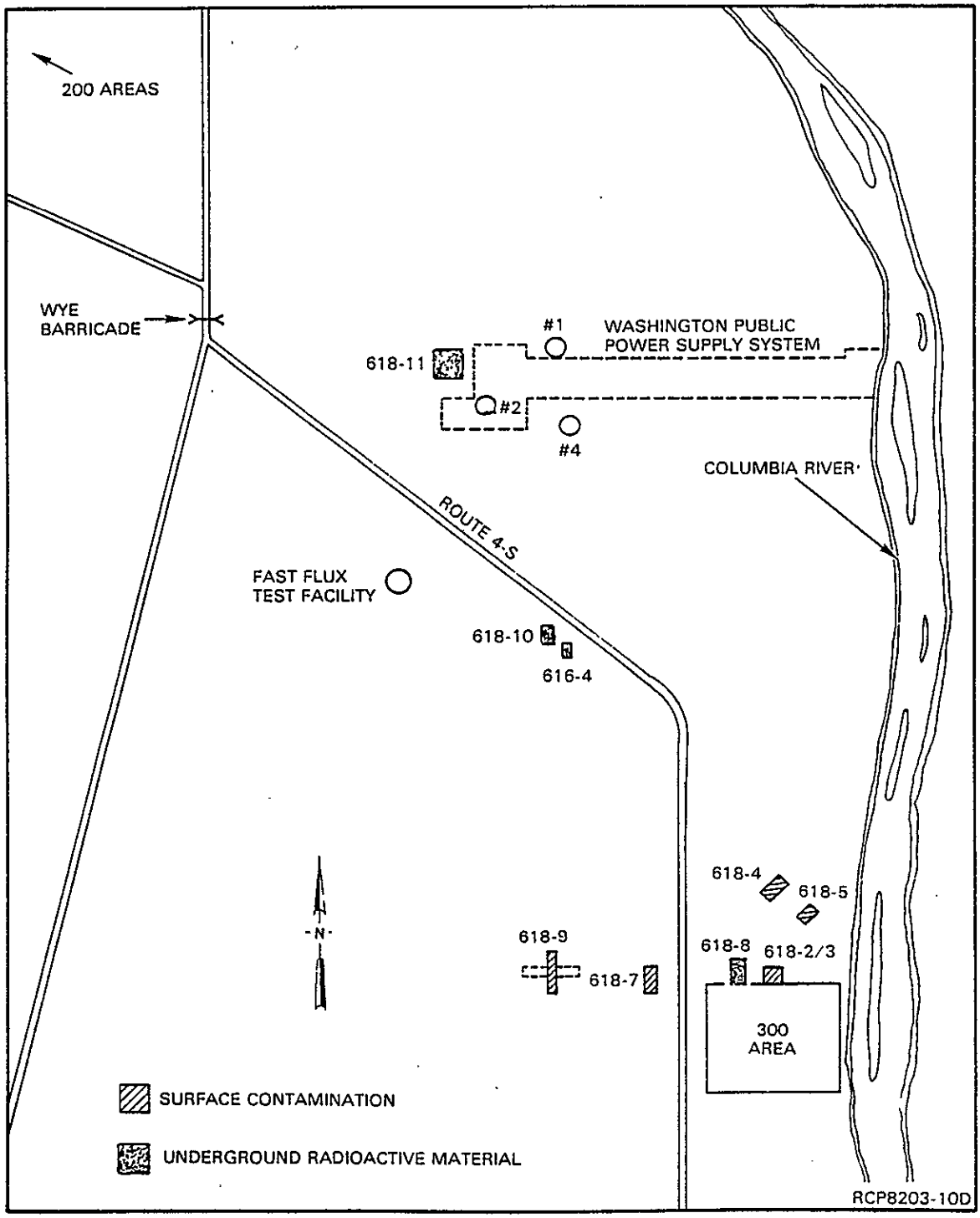
Table H-1. The 1989 Radiological Survey Schedule.

Interval	Areas scheduled for surveys
Quarterly	Water samples from sites for nitrate Road surveys outside 200 Outside East Area 200 Outside West Area Route 4-S from 200 West gate to 200E hill 216-A-8, 216-A-37-1, and 216-A-37-2 Cribs Tldexchange 216-U-12, 216-B-55, 216-B-62, 216-A-10, 216-A-30, 216-A-36-B, 216-U-16, 216-S-25, 216-S-26, 216-Z-20, 216-W-LWC, and 216-A-45 Cribs
Semi-Annual	All stabilized sites in 200/600 Areas (44 sites) BC controlled area roads and firebreaks BC crib ground plot survey Vent station perimeters
Annual	All cribs, trenches, and French Drains not surveyed elsewhere Survey of outside of buffalo units at 2101-M Roof tops at 200 East powerhouse 618 burial grounds Outside perimeters of all east and west area burial grounds 216-B-3-3 Ditch survey plots West lake shoreline survey plots 216-T-4 Ditch shoreline survey plots Snow's canyon ditch bank survey plots Underground pipeline from 216-B-2-3 Ditch Tank Farm perimeters and any inactive diversion boxes not inside Tank Farms 216-U-14 Ditch (active section) 216-B-3 Pond survey plots 216-B-63 Ditch Survey Plots 218-W-7 Burial vault 218-W-8 Burial vault 218-W-9 Burial vault All retention basin perimeters All unplanned release sites <u>MISCELLANEOUS BUILDING ROUTINES</u> (roofs, outdoor areas, and RR cuts) PUREX B-Plant REDOX T-Plant Z-Plant East Tank Farms (inside Tank Farm survey) West Tank Farms (inside Tank Farm survey)

Figure H-1. The 600 Area Burial Grounds.



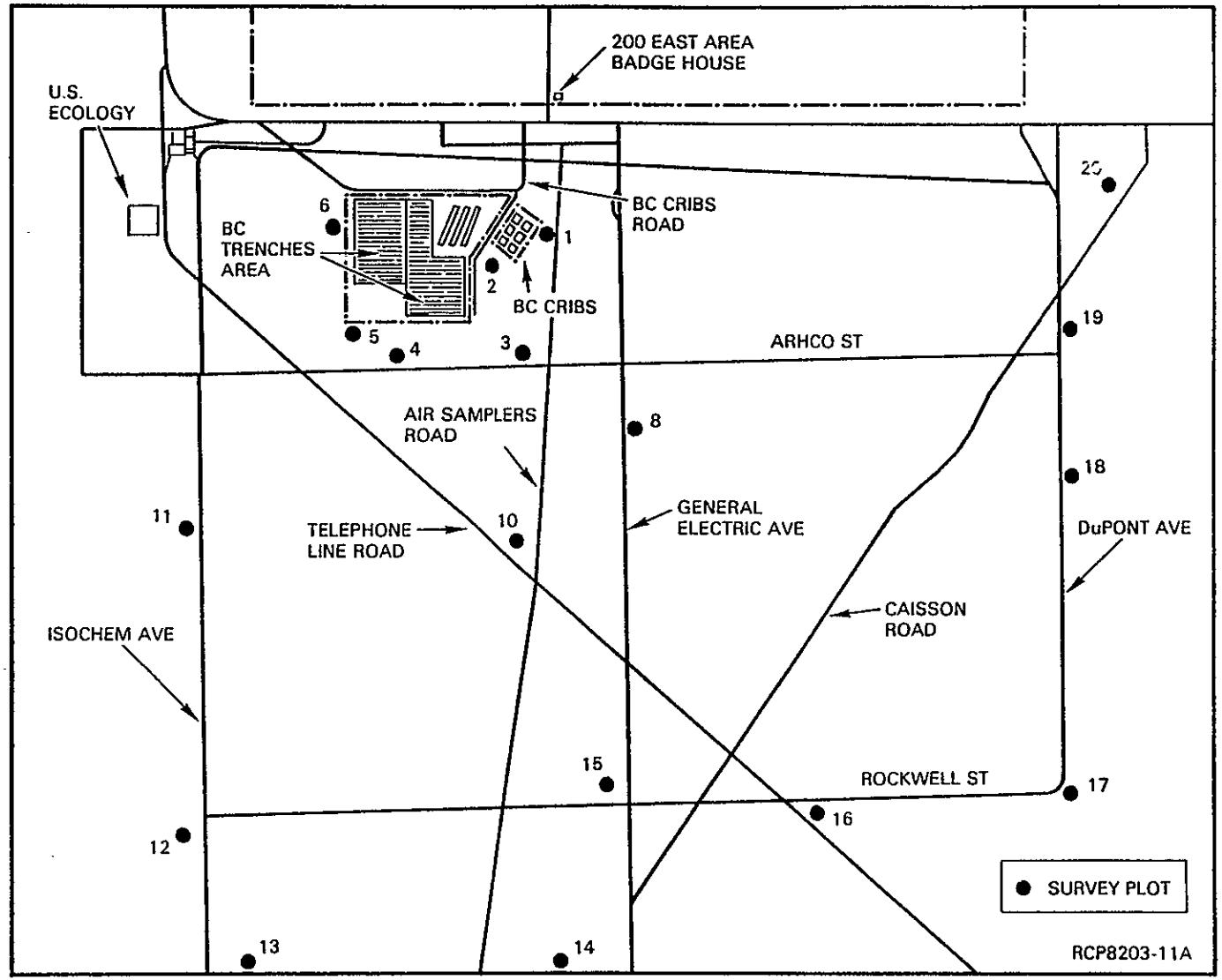


Figure H-2. The BC Cribs Controlled Area.

AIR SAMPLES

EDP CODE	LOCATION
N003	SW of Hot Semi
N006	N of AP Tank Farm
N007	S of AP Tank Farm
N008	E of AP Tank Farm
N012	NE of 207-A Retention Basin
N116	BC Crib North
N153	TX Tank Farm
N155	U Tank Farm
N157	BY Tank Farm
N158	AX Tank Farm
N159	B Stack
N161	T Stack
N165	216-Z-19 Ditch
N168	U-Stack
N177	Laundry
N301	EMER. SITE next to N965
N302	EMER. SITE next to N994
N303	EMER. SITE next to N963
N304	EMER. SITE next to N966
N305	EMER. SITE next to N980
N956	E of S/SX Tank Farm
N957	BC Crib Area
N960	U tank Farm (rep)
N961	Yakima Barricade
N962	SE of 218-W-4B burial ground
N963	SE of Redox
N964	E of 218-W-4B burial ground
N965	NE corner 200W
N966	200W Main Gate
N967	N of B/BX Tank Farm
N968	200E west gate
N969	SW of Purex
N970	NW of Purex
N971	SE of Purex
N972	NE of C Tank Farm
N973	E of B Tank Farm
N974	N of T Plant
N975	E of Z Plant
N976	Grid Site 2E17
N977	Grid Site 2E30
N978	Grid Site 2E35
N979	Grid Site 2E36
N980	Grid Site 2EA
N981	WYE Barricade
N982	Hanford Townsite
N983	E of 2101M
N984	SE of C Tank Farm

AIR SAMPLES (continued)

N985	W of 272-AW
N987	NE of TY Tank Farm
N991	Grout Site SE
N992	Grout Site NE
N993	Grout Site NW
N994	Gate 609

WATER SAMPLES

ID NUMBER	LOCATION
RM3	T-4 Ditch
RM18	216-B-63 Ditch
RM20	216-A-29 Ditch
RM21	216-B-3-3 Ditch
RM22	216-B-3 Pond East
RM23	216-B-23 Pond South
RM26	216-B-3 Pond Overflow
RM27	West Powerhouse Pond
RM28	216-S-10 Ditch
RM29	216-B-3 3rd Overflow
RM30	216-Z-21 Basin
RM53	West Lake

APPENDIX I

CONCENTRATION GUIDELINES

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Table I-1. Airborne Derived Concentration Guidelines.

Radionuclide	DCG (pCi/m3)
Sr-90	9
Cs-137	400
Ru-106	30
Pu-239	0.02

Table I-2. Groundwater Administrative Control Value Versus Derived Concentration Guidelines for Water (pCi/L).

Radionuclide	200 East	200 West	600 Area	DCG
H-3	None	None	None	2,000,000
Co-60	5,000	5,000	5,000	5,000
Sr-90	74	480	40	1,000
Tc-99	4,000	4,000	4,000	100,000
Ru-106	6,000	6,000	240	6,000
I-129	20	20	20	500
Cs-137	210	1,200	120	3,000
U-234	20	20	20	500
U-235, 238	24	24	24	600
Pu-238	2.0	3.6	1.6	40
Pu-239, 240	1.2	1.2	1.2	30

Table I-3. Surface Soil Concentration Guides.

Radionuclide	Guide (pCi/g)
Co-58	10,000
Co-60	5,000
Sr-90	600
I-129	4,000
Cs-134	10,000
Cs-137	20,000
Ce-144	1,900
Eu-152	3,000
Eu-154	3,000
Eu-155	20,000
Pu-238	75
Pu-239	75

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APPENDIX J

DATA SUMMARIES

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DATA SUMMARIES

Measuring any physical quantity has some degree of inherent uncertainty. This uncertainty results from the combination of all possible inaccuracies in the measurements process, including such factors as the reading of the result, the calibration of the measuring device, and numerical rounding errors. In this report, individual radioactive measurements are accompanied by a plus or minus (+/-) value, which is the uncertainty term known as a two-sigma counting error. The two-sigma counting error gives information on what the measurement might be if the same sample were counted again under identical conditions. The two-sigma counting error implies that approximately 95% of the time, a recount of the same sample would give a value plus or minus the two-sigma counting error. Values in the tables that are less than the two-sigma counting error indicate that the reported result might have come from a sample with no radioactivity. Such values are considered below the detection limits of the measuring instrument. Also note that each radioactive measurement must have the random background radioactivity of the measuring instrument subtracted; therefore, negative results are possible, especially when the sample has very little radioactivity.

Reported averages are also accompanied by two standard errors of the mean. If the data fluctuates randomly, then the standard error is a measure of the uncertainty in the estimated average of the data due to this randomness. If trends of periodic fluctuations are present, then the standard error is primarily a measure of variability in the trends and fluctuations about the average of the data, rather than a measure of the uncertainty of the estimated average due to random fluctuations in the data.

The average, X, was computed as

$$X = \frac{1}{n} \sum_{i=1}^{n} X_i$$

where X_i is the ith measurement and n is the number of measurements.

The standard error of X was computed as

$$SE = (S^2/n)$$

where S^2, the variance of the n measurements, was computed as

$$S^2_M = \frac{1}{n-1} \sum_{i=1}^{n} (X_i - X)^2$$

This estimator, S^2_M, includes the variance among the samples and the counting variance. The estimated S^2_M may occasionally be less than the average counting variance.

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